Section 6 – TFM Tools and Products

This section describes the tools / products used by TMUs at FAA air traffic control facilities.

Exhibit 6-1. TFM Tools / Products Usage Table provides the following information:

- The tools observed to be in use during the Audit Team's visits to ATCSCC, ZDC, ZAU, N90, SCT, WJHTC, and Volpe.
- The shaded columns denote field sites with TMUs and other organizations with ETMS / WSD / CCSD and the tools that have been intended for their use at these facilities.
- The TFM tools / products provided for General Aviation (GA) to be accessed via the phone or the ATCSCC Internet website.

This section includes the following subsections:

- Section 6.1, National TFM Tools – Descriptions of operational tools provided nationally for TMUs.
- Section 6.2, TFM Products – Descriptions of TFM products available.
- Section 6.3, Local TFM Tools – Descriptions of operational and support tools developed / acquired locally / regionally and observed to be in used at ZDC, ZAU, N90, and SCT.
- Section 6.4, Other TFM Tools – Descriptions of other FAA tools developed not specifically for TFM but used at TMUs.

Note that the following descriptions provide a snap shot in time of the tools' functionality and are subject to change.

	Tools observed to be in use at these facilities						Tools intended to be used at these facilities						
Tools/Products	**ATCSCC**	**ZAU**	**ZDC**	**N90**	**SCT**	**Volpe**	**ARTCC**	**TRACON**	**ATCT**	**AOC**	**Military**	**FAA HQ/Regional Offices**	**GA ***
National Tools/Products													
ACD				X				some					
Airport Demand Chart (ADC)							X	X	X	X			
Aggregate Demand List (ADL)	X	X	X	X	X		X	X	X	X			
ASDI						X				vendor			
ATCSCC Intranet	X	X	X	X	X	X	X	X	X	X	X	X	
CCFP	X	X	X	X	X		X	X	X	X	X		
CCSD						X				X			
CIWS		X	X	X									
CTAS Terminal					X								
CVRS/eCVRS	X		X				X						X
Delay Manager													
DSP	X			X			limited	limited	limited				
DSR		X	X				X						
DRWP	X									X			
ESIS			X		X		X						
ETMS	X	X	X	X	X	X	X	X	X		limited	X	
ETMS Autosend	X						X	X	X				
ETMS Email	X	X	X	X	X	X	X	X	X				
ETMS Log (LOG)	X						some	some	some				
FEA/FCA	X	X					X	X	X	X			
FDAD					X			some					
FSA Post Analysis	X		X			X	X					X	
FSA Real Time	X			?	?		X			?			
FSM	X			X	X	X	X	X	X	X			
ITWS	X		X	X				X		?			
MA	X	X	X				X	X	X				
OIS	X	X	X	X	X	X	X	X	X	X	X	X	X
PFWP	X						?			X			
POET	X	X	X	X	X	X	X	X	X				
RAPT (Concept Evaluation)			X	X					NY only				
RMT	X	X	X				X			X			
Route Manager			X										
RVR	X			X			X	X	X	X			
STMP/eSTMP	X	X	X				X						X
TMA					X		limited						
TMLog	X				X		some	some					
TMShell						X							
TSD	X	X	X	X	X	X	X	X	some		limited	X	
Volpe Intranet	X					X				X		X	
WARP	X	X	X				X						
WSD						X			some		X	X	
Local tools													
Blue Log			X	X									
N90 SIA				X									
N90 TCAP				X									
SAIDS		X	X	X	X		X	X	X				
SCT CTAS Terminal					X								
SCT Demand Spreadsheet					X								
SCT PDARS Tool					X								
SCT Traffic Counters					X								
TMC Tools			X	X									
ZAU MAU Tool		X											
ZAU Monitor Alert Tool		X											
ZAU Restriction Manager		X											
ZAU SWAP Tool		X											
ZAU TMU Information Manager		X											
ZAU TMU Log		X											
ZDC RT Find			X										

* General Aviation (GA) is assumed to be accessing the TFM tools/products via phone or ATCSCC Internet site.

Exhibit 6-1. TFM Tools/Products Usage Table

6.1 National TFM Tools

The following are operational tools provided nationally for TMUs.

6.1.1 ATCSCC Intranet Website

6.1.1.1 Overview

The ATCSCC Intranet website is an information sharing tool that fosters collaboration between FAA facilities and system users in the strategic planning of air traffic flow. Users of the website include the ATCSCC, FAA enroute and terminal ATC facilities via ADTN2000, and Airline Operations Centers (AOCs) via CDMnet.

The ATCSCC Intranet website provides authorized users with portal access to a wide variety of CDM products and information. The following table lists the products and information that are accessible from the ATCSCC Intranet Home Page as of October 2002. Note that the RT FSA and the TCA tools are accessible via the OIS page. Also this website undergoes continual modifications with each new releases of software to meet changing needs.

Exhibit 6-2. ATCSCC Intranet Home Page

Products Available from the ATCSCC Intranet Home Page	
Advisories Database Access/Most Recent Advisory	ETMS Technical Notes
Airport Arrival Demand Chart	NAS Status Information (NASSI)
Airspace Management Tool	Open Systems Trouble Tips
ATCSCC Logs	Operational Information System (OIS)
ATCSCC Proficiency Training	OPSNET Reports
ATCSCC Standard Operations Procedures	Pathfinder (PFWP)
Common Constraint Situation Display (CCSD)	Route Management Tool (RMT)
Central Altitude Reservation Function (CARF)	Runway Visual Range (RVR)
Collaborative Convective Forecast Product (CCFP)	Special Use Airspace Management System (SAMS)
Diversion Recovery (DRWP)	STMP Database
e-Special Traffic Management Program (e-STMP)	Web-Based Situation Display (WSD)
ETMS Site Program Bulletins	
Information Categories Available from the ATCSCC Intranet Home Page	
Automation	QA
Information	Training
Operations Information	What's New
Procedures	

6.1.1.2 Functions

The ATCSCC Intranet web site requires users to log on with a username and password. The user/site access list is maintained by ATT-220. Unless otherwise specified on the Home Page, all users have read access to the information on the website. The ability to add or update information within each of the products on the website is specific to the product.

Each of the products and information categories is briefly discussed below. Some of the products are further discussed in other subsections of Section 6.

6.1.1.2.1 Advisories Database Access/Most Recent Advisory

FSM and ETMS email are configured to send a copy of each advisory to the Advisories Database application. This application parses the advisories and adds them to an Oracle database. The advisories are displayed through a web interface on the ATCSCC Intranet.

The Advisories Database page allows users to display ATCSCC advisories, Canadian advisories, or both, for a specified date. An additional selection filter can be applied to select one or more categories of ATCSCC advisories. The ATCSCC categories are: Ground Stops, Ground Delay Programs, Route Advisories, and Other Kinds of Advisories. The selection results are displayed in a table format in reverse chronological order (i.e., most recent first). The advisory number, affected facilities, date, brief title, and sent date/time are provided for each advisory. The user clicks on the advisory number to view the advisory text.

The Advisories Database and the web interface to it are developed and maintained by Kenrob and Associates Inc.

Exhibit 6-3. ATCSCC Intranet Advisories Database Selection Screen

6.1.1.2.2 Airport Arrival Demand Chart

The Airport Arrival Demand Chart (AADC) displays the latest arrival demand metrics for selected airports. The chart is a web-enabled FSM demand chart for a specified location. The web page accesses the FSM server at the Command Center and formats the data for web display. It is implemented using Java. Refer to Section 6.2.1, Airport Demand Chart (ADC) / Airport Arrival Demand Chart (AADC), for additional information.

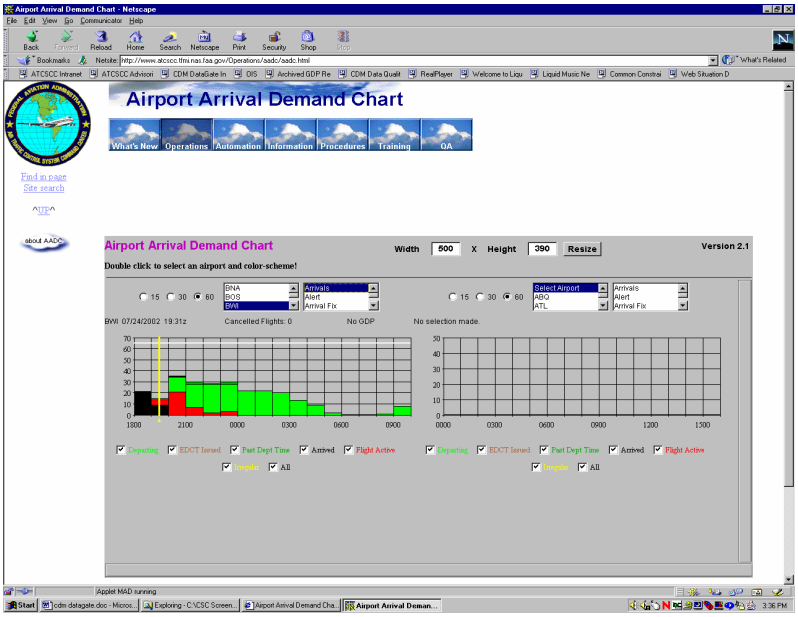


Exhibit 6-4. Airport Arrival Demand Chart

6.1.1.2.3 Airspace Management Tool

The ETMS Airspace Management Tool (formerly, the Sector Management Tool) helps traffic managers develop 'what-if' solutions to predicted sector or FCA traffic loading problems. The Airspace Management Tool calculates the minute-by-minute traffic load in a sector or FCA and then applies a smoothing method to reduce projected traffic to the capacity threshold by adding delay minutes to the departure times of selected flights.

Traffic managers can use the Airspace Management Tool to examine potential solutions to sector loading problems identified by ETMS Monitor Alert or to help deal with FCA loading problems. By changing the *exclusion*, *exemption*, and *control* parameters that the Airspace Management Tool uses, the traffic manager can refine the proposed solution and, when satisfied with the solution, issue a ground delay program from the Airspace Management Tool to implement the ground delays settled upon.

The Airspace Management Tool uses sector capacities, flight lists, and flight control status from ETMS. Analysis results are displayed in the browser window in four frames: the flight list frame, the summary frame, the smoothed demand bar chart, and the input frame. The first three frames show data about the current proposed solution. The fourth frame is for input and

it is used as a working form for the final decision-making process. Exhibit 6-5. Airspace Management Tool Scenario Display describes the scenario display.

Exhibit 6-5. Airspace Management Tool Scenario Display

Frame	Location	Description
Bar Chart	Lower right	Shows a graphical representation of the sector traffic load, which factors in any proposed delays.
Summary	Upper right	Contains general information about the scenario and proposed delays. It includes the number of delayed flights and the average, minimum, and maximum delays for the proposed solution. Links are provided to view the delay breakdown by airline or departure center.
Flight List	Left side	Shows the list of flights predicted to be in the airspace during the specified time period. Several data fields including aircraft id, origin, destination, proposed delay minutes, minutes in sector, proposed ETD, and ETA appear for each flight. The times displayed include any proposed delay time. The flight name may be color-coded to represent a particular status.
Input Exclusions Exemptions Control Parameters Action Buttons	Center right	Allows completion of an *Airspace Management Tool* session for this scenario. A new scenario can be generated by modifying the exclusion, exemption, and/or control parameters or The proposed solution can be implemented.

The Airspace Management Tool provides the traffic manager with the choice of remodeling the scenario or updating the data used in the scenario. Depending on how the tool is configured, the traffic manager may also be allowed to implement the proposed solution. If the traffic manager chooses to implement the proposed solution, the Airspace Management Tool invokes the ETMS Autosend feature and incorporates the ground delay program into ETMS for issuing Control Times (CTs) and other command requests.

The Airspace Management Tool is developed and maintained by Kenrob and Associates Inc. Refer to the ETMS Airspace Management Tool Version 7.09 Training Document for additional tool information.

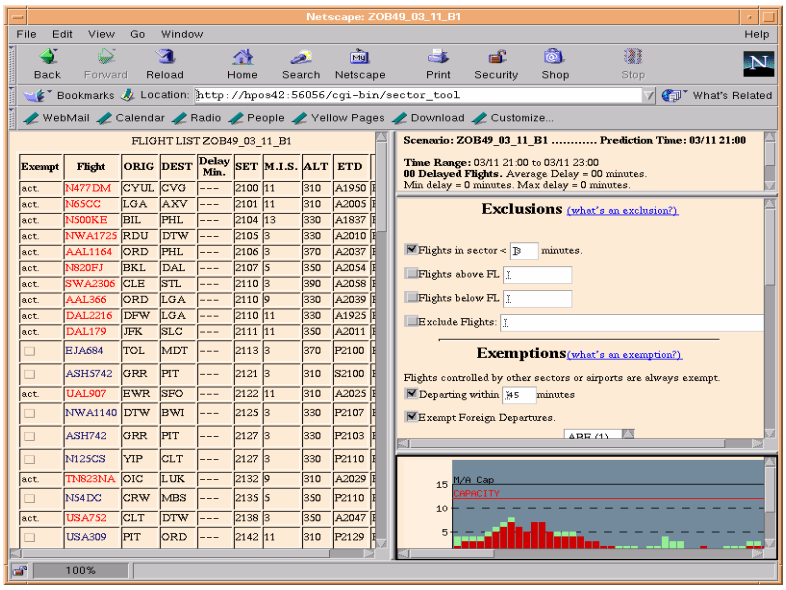


Exhibit 6-6. Airspace Management Tool Scenario Output Display

6.1.1.2.4 ATCSCC Logs

The ATCSCC Logs page allows users to browse the position logs from the current day or from a selected previous day. Entries for the current day's position logs are retrieved from the floor every five minutes. Users scroll down the pages to see the full log.

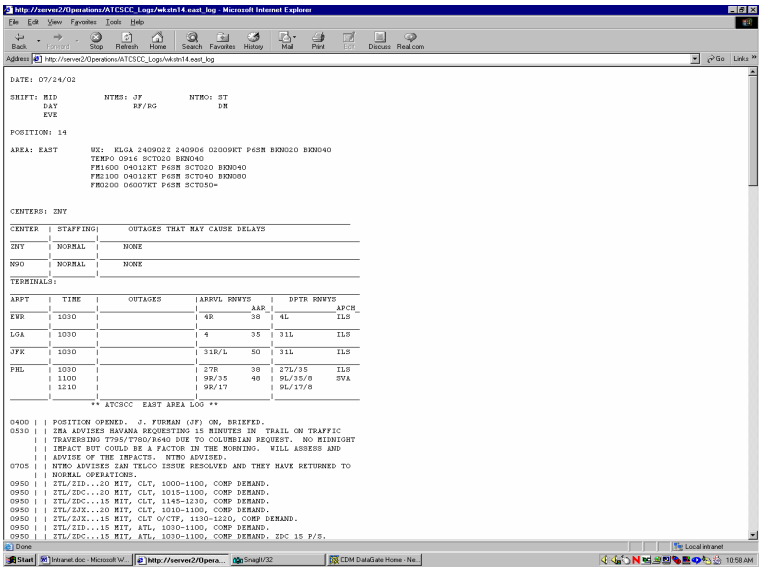


Exhibit 6-7. ATCSCC Intranet Display of a selected ATCSCC Log

6.1.1.2.5 ATCSCC Proficiency Training

The ATCSCC Proficiency Training web page lists the intended recipients of the required monthly ATCSCC proficiency training and the process for completing it. The process includes reviewing the required training documents by the last day of the month and completing and submitting the proper form through the listed channels.

The ATCSCC Proficiency Training web page provides links to monthly proficiency training requirements for the current month and all previous months from August 2001 forward. There also is a link to System proficiency training for the year 2000. Each monthly proficiency training web page (accessed via the icons on the left of the Proficiency Training cover page depicted below) lists the items that must be reviewed for each ATCSCC position during that month. A link to the document, or directions on how to obtain a copy of the document, is provided.

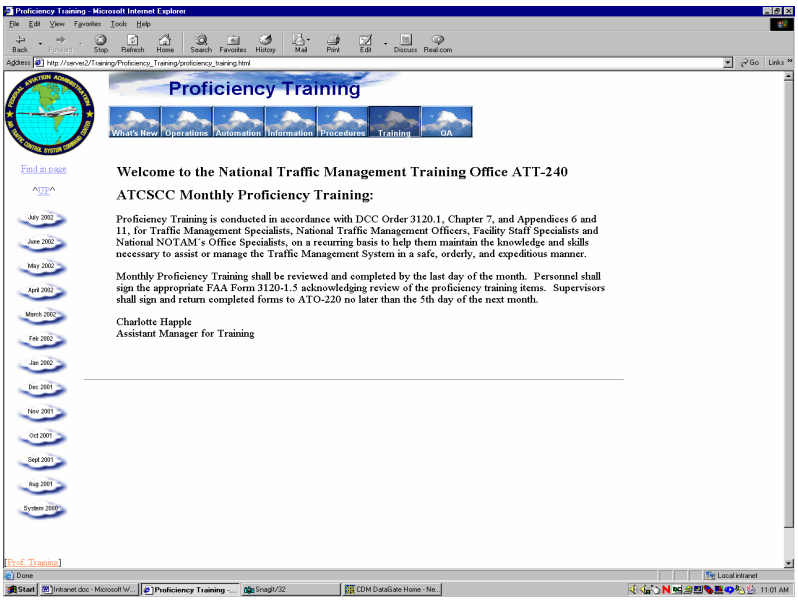


Exhibit 6-8. Proficiency Training Cover Page

6.1.1.2.6 ATCSCC Standard Operations Procedures

As of July 2002, the ATCSCC Standard Operations Procedures web page contains links to the following:

- NMCC Standard Operations Procedure
- Advisory Circulars
- National Orders and Notices
- Local Orders and Notices
- ATCSCC Standard Operating Procedures
- DCC 7200.100C ATCSCC Standard Operating Procedures – Effective 07/01/2002

- DCC 7200.100C ATCSCC Standard Operating Procedures Briefing Guide
- DCC 7200.100C ATCSCC Standard Operating Procedures Explanation of Changes.

6.1.1.2.7 Common Constraint Situation Display (CCSD)

The CCSD is a Web-based product used by the airlines to view the same traffic demand and constraint information as the traffic managers. It is available via CDMnet or the ATCSCC Intranet website. The displays are similar to the TSD except that flight icons are not depicted. Refer to Section 6.1.2, CCSD, for additional information.

6.1.1.2.8 Central Altitude Reservation Function (CARF)

TM specialists, who have received specific training in military coordination activities, perform the Central Altitude Reservation Function (CARF) from a secure room at the ATCSCC. CARF supports U.S. peace and war plan objectives and other special activities. CARF is responsible for coordinating military and civilian altitude reservations for operations within the NAS. CARF personnel must be able to determine when military operations, national security aircraft operations, and other civilian emergency operations require special traffic management coordination. The ATCSCC is involved in the CARF coordination process, in particular with handling Altitude Reservation (ALTRV) requests.

The ATCSCC web page provides links to CARF related training and contacts. The process for registering for the CARF Indoctrination Course is described. The CARF Indoctrination Course familiarizes military unit project officers and FAA personnel with the policies, procedures, and responsibilities applicable to the planning, coordination, and approval of Altitude Reservation (ALTRV) requests. The course concentrates on ALTRV procedures, mission-planning considerations, and preparation of the various messages used in the ALTRV process.

An ALTRV is required when a number of military aircraft must be moved with less IFR separation between aircraft than is allowed by standard ATC criteria (e.g., military aircraft that join a tanker for refueling), or when a number of aircraft must operate within prescribed altitudes, times, and/or areas. Military operations that are normally conducted in airspace expressly designated for a special activity do not require an ALTRV.

An ALTRV reserves a 3-dimensional block of airspace during a specific timeframe for the conduct of special military activities. An ALTRV request receives special handling from FAA facilities. When an ALTRV is requested, the military contacts the ATCSCC. The ATCSCC specialist works with the affected ARTCCs to ensure that the ALTRV is not in conflict with the traffic flow, available routes, military missions, and other operations that propose to use the requested airspace. If there is a conflict the ALTRV is not approved.

CARF is responsible for separation of the ALTRV mission from other ALTRV's after the aircraft have reached the first cruising altitude to a point where descent is started into the destination airport or where the ALTRV ends.

ALTRVs are either moving or stationary. A moving ALTRV normally includes the en route and arrival phases of flight up to, and including, the arrival holding pattern at which ATC provides

separation between aircraft. A moving ALTRV moves in relation to the aircraft operating within it. A stationary ALTRV normally defines the fixed airspace area to be occupied as well as the specific altitude(s) and time period(s) the area will be in use.

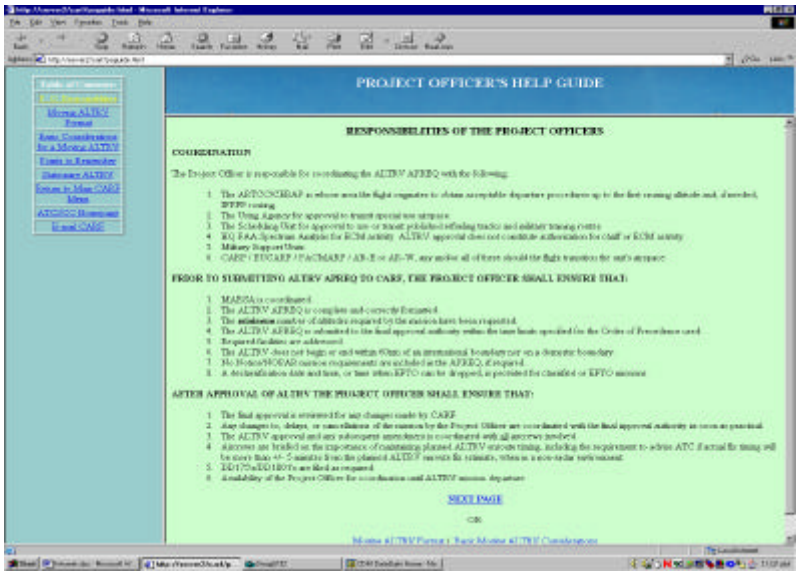


Exhibit 6-9. CARF Pages - Project Officer's Help Guide

6.1.1.2.9 Collaborative Convective Forecast Product (CCFP)

In order to mitigate weather-induced disruptions, NAS users and participating meteorologists have developed the Collaborative Convective Forecast Product (CCFP). CCFP is an alternative to the conventional aviation weather forecasting for convective activity during the April through September severe weather period. CCFP consists of a process by which an initial forecast produced by the Aviation Weather Center (AWC) in Kansas City evolves into a final product through collaboration by participating meteorologists from the airlines and the Center Weather Service Unit (CWSU). CCFP is a component of the FAA's CDM process. The ATCSCC Intranet Home Page links to the CCFP located on the AWC Internet web site.

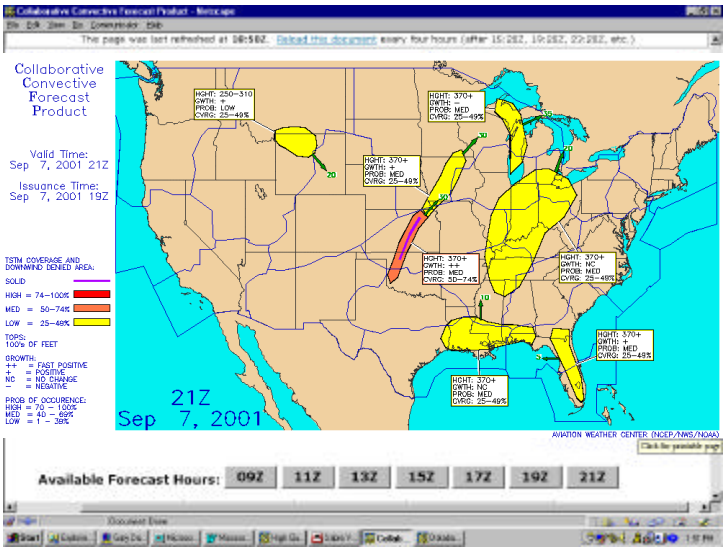


Exhibit 6-10. CCFP Web Page

6.1.1.2.10 Diversion Recovery Web Page (DRWP)

The Diversion Recovery web page provides the FAA and the airlines with an automated, real-time, interactive traffic management decision support system for identifying, monitoring, and tracking diverted flights through their recovery process. Refer to Section 6.1.6, DRWP, for additional information.

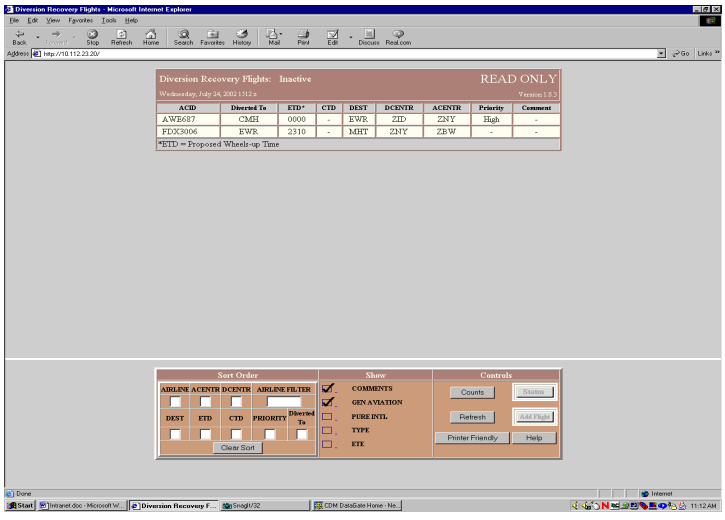


Exhibit 6-11. Diversion Recovery Web Page

6.1.1.2.11 E-Special Traffic Management Program (e-STMP)

The e-STMP web page allows users to request, confirm, update, and cancel a reservation online for a specific special event. Refer to Section 6.1.8, e-STMP, for additional information.

Exhibit 6-12. e-STMP Web Cover Page

6.1.1.2.12 ETMS Site Program Bulletins

The ETMS Site Program Bulletins web page includes links to site program bulletins that have been published since October 1998. Users can choose to browse online versions or to view the files using Acrobat Reader. The Adobe version (a file with a '.pdf' extension) may be printed.

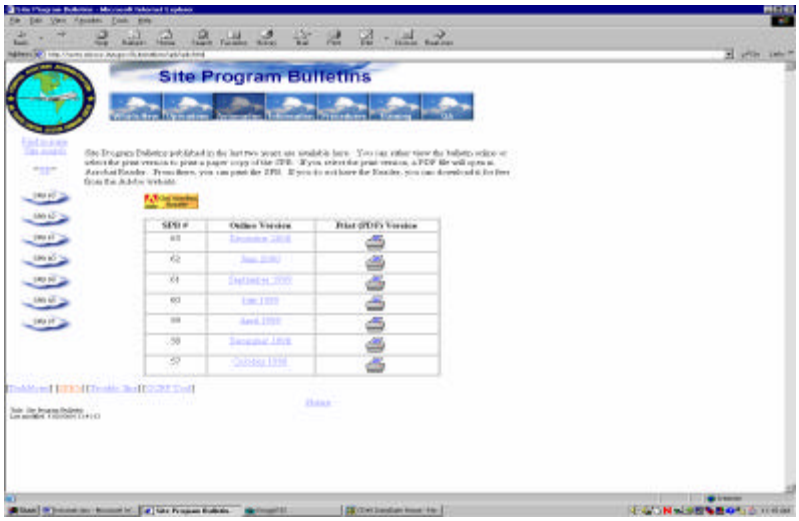


Exhibit 6-13. Site Program Bulletin Page

6.1.1.2.13 ETMS Technical Notes

The ETMS Technical Notes web page provides a list of HP-UX technical notes that are currently available. Each entry in the list is linked to the actual technical note. Users can choose to browse online versions or to view note files using Acrobat Reader. The Adobe version is easily printable.

6.1.1.2.14 NAS Status Information (NASSI)

The NAS Status Information (NASSI) web page presents a presentation of the Free Flight Phase I (FFP1)/CDM Program Office NY TRACON Limited Deployment Prototype Data Exchange Demonstration. The demonstration involves near real-time data collection, processing and network dissemination of FAA Operational data at the NY TRACON made available to the ATCSCC. This page includes links to Automated Terminal Information System (ATIS), (METAR), and (TAF) data for five New York airports: JFK, LaGuardia, Newark, Teterboro, and Islip.

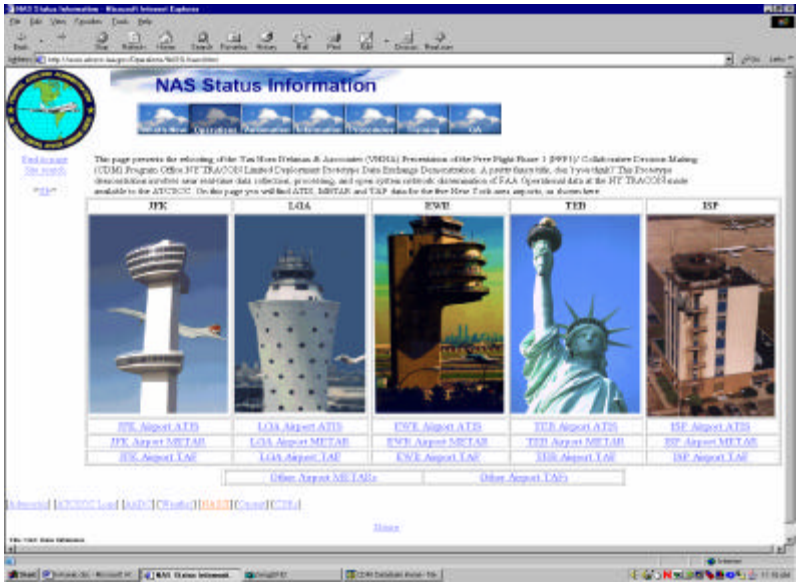


Exhibit 6-14. NAS Status Information Cover Page

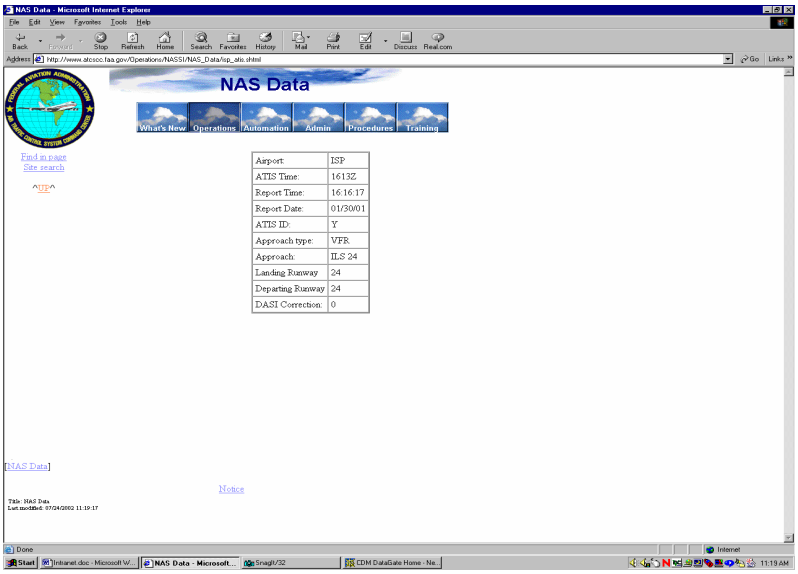


Exhibit 6-15. ATIS Data for a Selected Airport

6.1.1.2.15 Open Systems Trouble Tips

The Open Systems Trouble Tips web page provides information on ETMS issues. It contains links to ETMS tips and procedures, known problems and status, and information on changes provided by the current software release. Information is organized into the following categories: TSD, List Requests, Flight Data, Changes, Logs, Monitor Alert, Delay Manager, System Administration, E-mail, and Miscellaneous. The ETMS Hotline number is also provided.

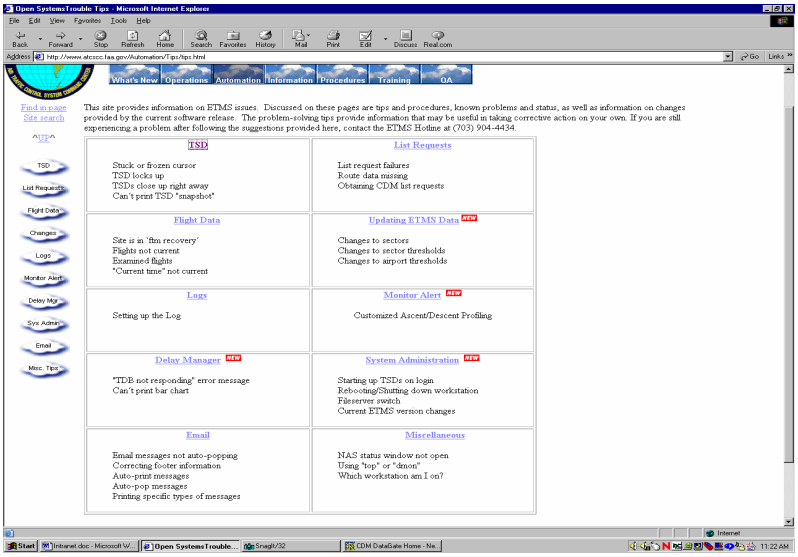


Exhibit 6-16. Trouble Tips Cover Page

6.1.1.2.16 Operational Information System (OIS)

The Operational Information System (OIS) is a specialized informational system that provides critical and rapidly changing information to air traffic control personnel via the ATCSCC Intranet. It provides controllers and traffic managers with important information such as Ground Stops, Ground Delays, airport delays, deicing programs, VIP movement, airport equipment and runway outages, controller duty schedules, and more. The RT FSA and TCA Tool are accessible from the OIS page. Refer to Section 6.2.5, OIS, for additional information.

6.1.1.2.17 OPSNET Reports

The OPSNET Reports web page provides links to published OPSNET monthly and daily reports. Users can access each of the following 15 types of daily OPSNET reports.

1. Air Traffic Delays
2. OPSNET Delay Report
3. Total OPSNET Delays
4. Delay Summary Report
5. OPSNET Equipment Outage Report
6. Traffic Summary Report
7. Daily NAS Traffic Report by Center
8. Daily NAS Traffic Report by Select Airport
9. Daily NAS Traffic Report by Select TRACONs
10. TMS Daily Report
11. Charge to Delay Report
12. Instrument Approaches
13. NAS Performance Report
14. Daily NAS Traffic Report by Non Selected Airport
15. Daily NAS Traffic Report by Instrument Operations.

Users can choose to browse online versions or to view the various reports in Adobe format (.pdf extension) using Acrobat Reader. The Adobe version is easy to print out, however, it is not possible to copy data directly from an Adobe file for further analysis.

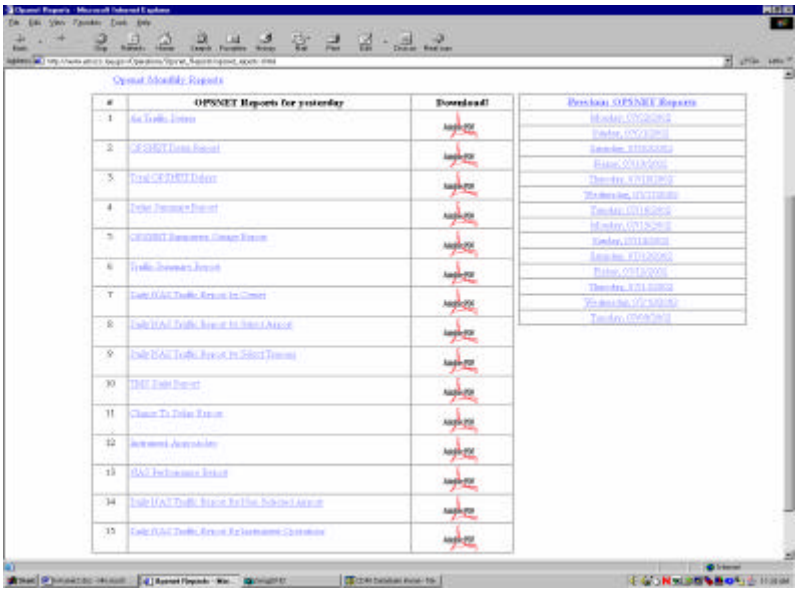
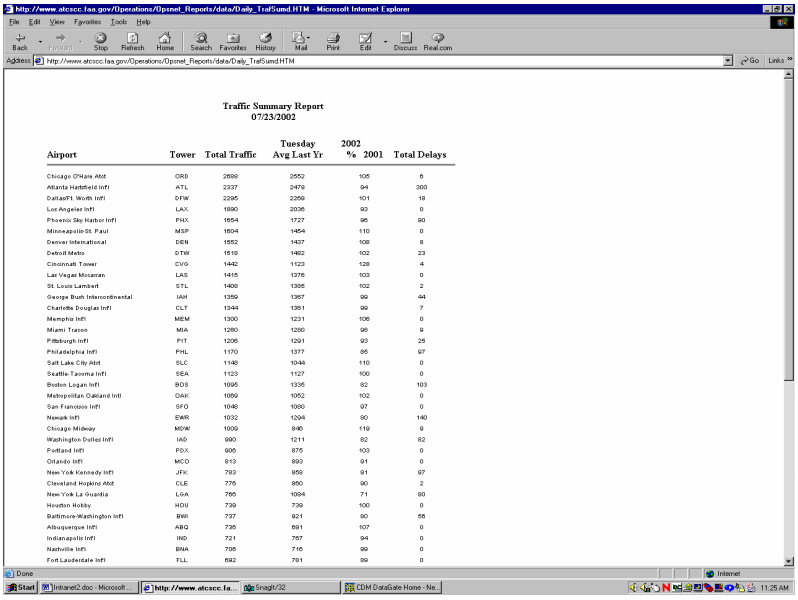


Exhibit 6-17. Access for OPSNET Reports



Traffic Summary Report
07/23/2002

Airport	Tower	Total Traffic	Tuesday Avg Last Yr	2002 % 2001	Total Delays
Chicago O'Hare Intl	ORD	2699	2552	105	6
Atlanta Hartsfield Intl	ATL	2337	2479	94	300
Dallas/Ft. Worth Intl	DFW	2295	2269	101	18
Los Angeles Intl	LAX	1890	2036	93	0
Phoenix Sky Harbor Intl	PHX	1654	1727	96	90
Minneapolis-St. Paul	MSP	1594	1454	110	0
Denver International	DEN	1552	1437	108	8
Detroit Metro	DTW	1518	1482	102	23
Cincinnati Tower	CVG	1442	1123	128	4
Las Vegas Mccarran	LAS	1416	1376	103	0
St. Louis Lambert	STL	1408	1386	102	2
George Bush Intercontinental	IAH	1359	1367	99	44
Charlotte Douglas Intl	CLT	1344	1361	99	7
Memphis Intl	MEM	1300	1231	106	0
Miami Tracon	MIA	1260	1260	98	9
Pittsburgh Intl	PIT	1206	1291	93	25
Philadelphia Intl	PHL	1170	1377	85	97
Salt Lake City Intl	SLC	1148	1044	110	0
Seattle-Tacoma Intl	SEA	1123	1127	100	0
Boston Logan Intl	BOS	1095	1335	82	103
Metropolitan Oakland Intl	OAK	1059	1052	102	0
San Francisco Intl	SFO	1048	1080	97	0
Newark Intl	EWR	1032	1294	80	140
Chicago Midway	MDW	1009	846	119	9
Washington Dulles Intl	IAD	990	1211	82	62
Portland Intl	PDX	906	875	103	0
Orlando Intl	MCO	813	893	91	0
New York Kennedy Intl	JFK	783	858	91	97
Cleveland Hopkins Intl	CLE	776	860	90	2
New York La Guardia	LGA	765	1084	71	80
Houston Hobby	HOU	739	739	100	0
Baltimore-Washington Intl	BWI	737	821	90	56
Albuquerque Intl	ABQ	736	691	107	0
Indianapolis Intl	IND	721	767	94	0
Nashville Intl	BNA	706	716	99	0
Fort Lauderdale Intl	FLL	692	781	89	0

Exhibit 6-18. OPSNET Traffic Summary Report

6.1.1.2.18 Pathfinder Web Page (PFWP)

The Pathfinder Web Page gives airlines a simple and effective way to convey to the FAA important information about flights wishing to volunteer as the pathfinder during severe weather. Access to the Pathfinder web page is restricted to airline users and the Tactical Consumer Advocate (TCA). Refer to Section 6.1.16, PFWP, for additional details.

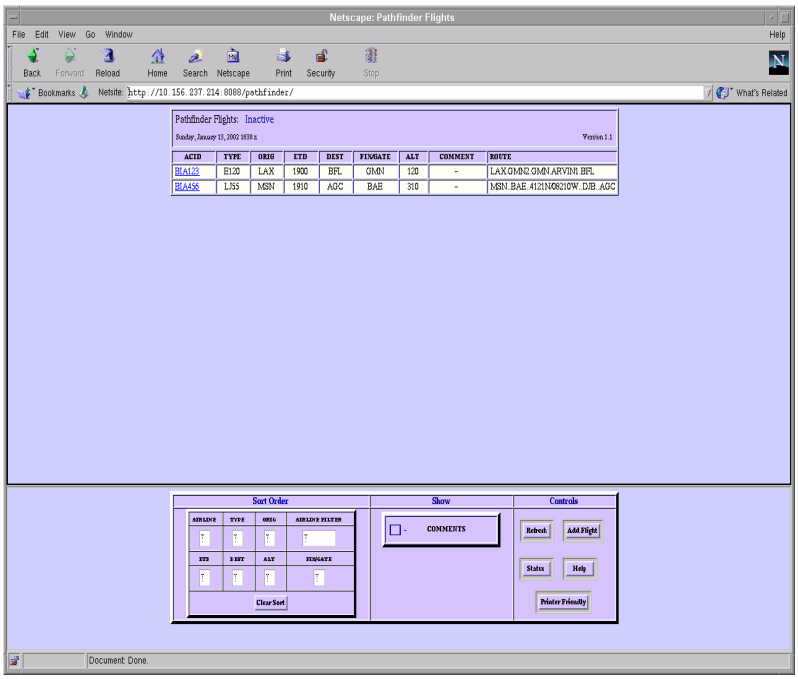


Exhibit 6-19. Pathfinder Web Page

6.1.1.2.19 Route Management Tool (RMT)

The Route Management Tool (RMT) provides a way to manage the Coded Departure Route (CDR) database by allowing users to view, add to, or modify the operational and staging databases. CDRs are used to reduce coordination time during severe weather or departure congestion events and to standardize route coordination for the user community. In addition, RMT allows users to view released National Flight Data Center (NFDC) data containing preferred routes and location identifiers, and airway intersection tables. Refer to Section 6.1.18, RMT, for additional details.

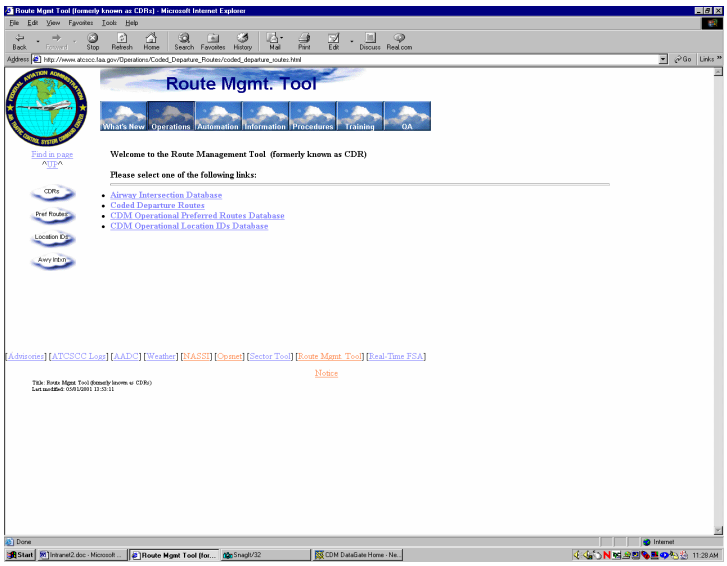


Exhibit 6-20. Route Management Tool Cover Page

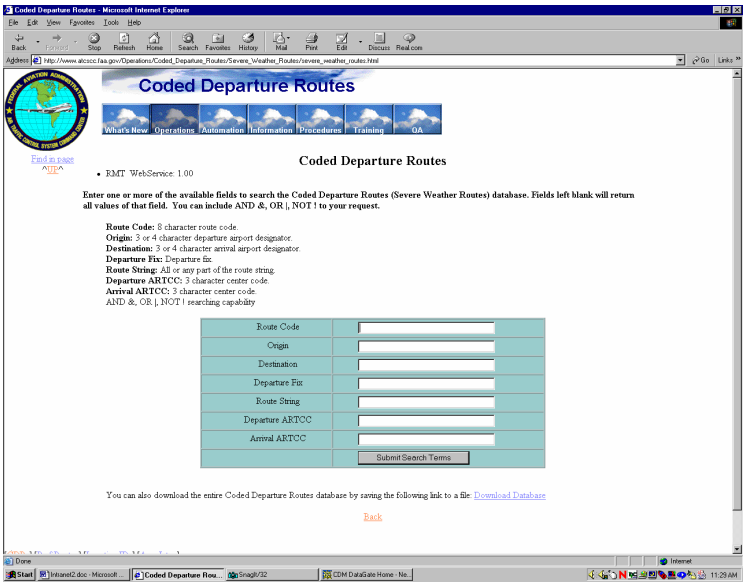


Exhibit 6-21. Route Management Tool – CDR Database Query Page

6.1.1.2.20 Runway Visual Range (RVR)

The Runway Visual Range (RVR) web page allows NAS users to view current and historical RVR data from selected airports. RVR data includes visibility, ambient light, and runway lighting intensity along an airport runway. Currently, users can receive touchdown, midpoint, and rollout RVR data for 48 airports, as well as the edge and centerline lighting settings. Refer to Section 6.1.20, RVR, for additional details.

6.1.1.2.21 Special Use Airspace Management System (SAMS)

The Special Use Airspace Management System (SAMS) displays and records SUA and other types of airspace area transactions tracked in the National Airspace System (NAS). It was developed as a joint coordination effort between the FAA and Department of Defense (DOD) to increase flexibility in the allocation and use of SUA by civil and military users. SAMS is available to ADTN 200 users only. It has an open-system architecture and has the potential to interface with other systems such as ETMS and the Military Airspace Management System (MAMS). ATO 130 maintains the SAMS database and prepares/distributes SAMS data analysis.

Access to the SAMS web page is restricted to authorized SAMS users.

6.1.1.2.22 STMP Database

The STMP database defines special events that place unusual demands on airport arrivals and departures. The Indianapolis 500 is an example of a special event. STMP administrators at the ATCSCC make entries in the STMP Database during the planning phase for each special event. The ATCSCC Intranet provides a link to STMP administration tools. Refer to Section 6.1.8, e-STMP, for additional details.

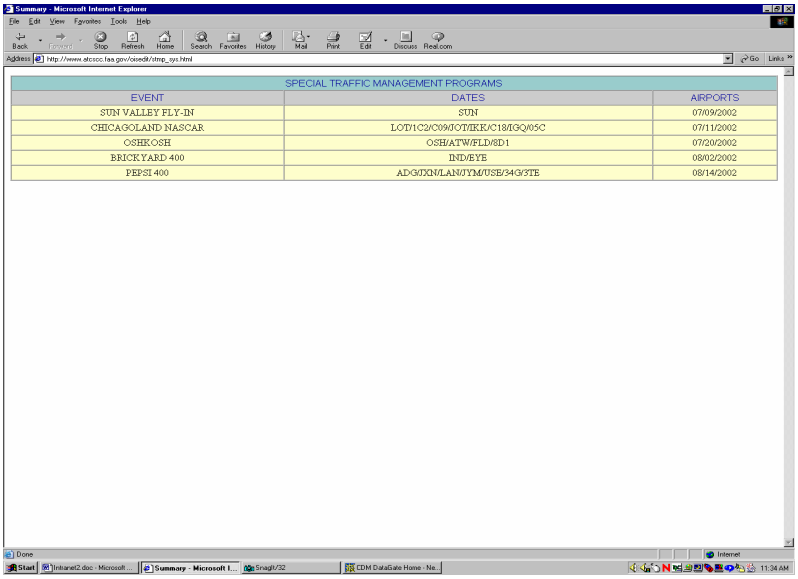


Exhibit 6-22. e-SMTP Event Database

6.1.1.2.23 Web-based Situation Display (WSD)

WSD is a low-cost approach to access ETMS without installing the complete ETMS hardware and software. WSD is a web-based product that provides users with access to the same traffic demand and constraint information as those sites with full ETMS installation. WSD is for use by FAA and other authorized government agencies (e.g., military) whereas CCSD, another web-based ETMS display product, is for use by the airlines. FAA users access WSD via the ATCSCC Intranet and other users with proper authorization can access WSD via the Internet. See Section 6.1.25, WSD, for additional information.

6.1.1.2.24 Automation

The ATCSCC Intranet web site provides access to seven topic areas, one of which is "Automation". The Automation section of the web site contains technical information relevant to the support of various air traffic management systems. Links to the following are provided:

- HP-UX technical notes
- ETMS Site Program Bulletins (SPBs)

- ETMS TSD documentation in PDF format
- Open system trouble tips (provides quick fixes to common problems)
- CCFP Tool (restricted to CSA use; initiates transfer of the CCFP images from the Aviation Weather Center (AWC) in Kansas City.

6.1.1.2.25 Information

The ATCSCC Intranet web site provides access to seven topic areas, one of which is "Information". The Information section of the web site contains warnings and privacy notices connected to the web site.

6.1.1.2.26 Operations Information

The ATCSCC Intranet web site provides access to seven topic areas, one of which is "Operations". The Operations section of the web site contains links to the Airport Arrival Demand Chart, the ATCSCC daily logs, OPSNET reports, Route Management Tool, and NAS Status Information. These are all individually described throughout this section.

6.1.1.2.27 Procedures

The ATCSCC Intranet web site provides access to seven topic areas, one of which is "Procedures". The Procedures section of the web site is described in Section 6.1.1.2.6 ATCSCC Standard Operations Procedures above.

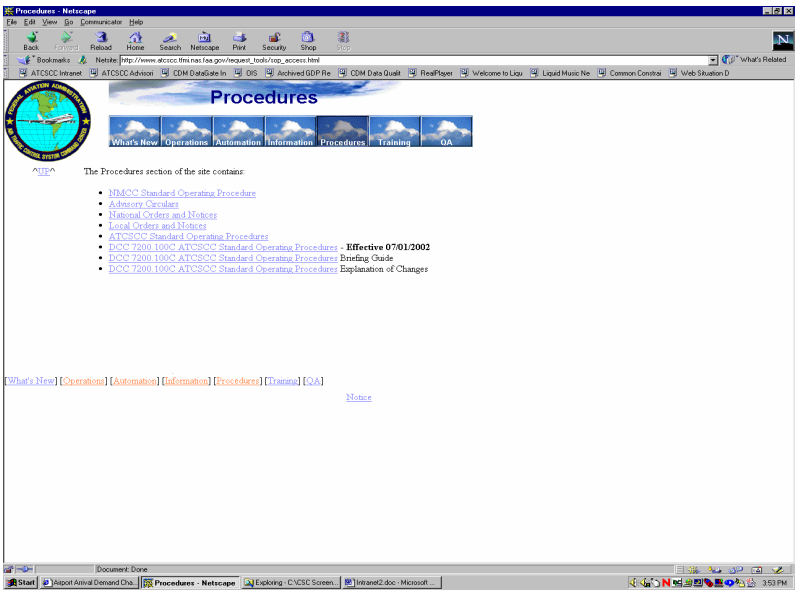


Exhibit 6-23. Procedures Information Cover Page

6.1.1.2.28 QA

The ATCSCC Intranet web site provides access to seven topic areas, one of which is "QA". The QA section of the web site contains links to information about the ATCSCC QA organization, QA analysis results, QA newsletters, QA lessons learned, QA bulletins, Operational Review Board (ORB) procedures, and OPSNET misuses and Frequently Asked Questions (FAQs).

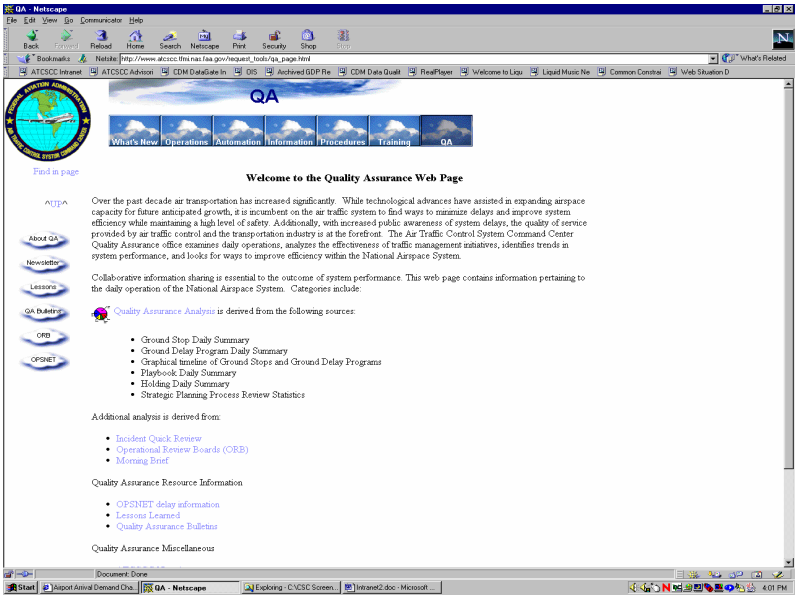


Exhibit 6-24. Quality Assurance Cover Page

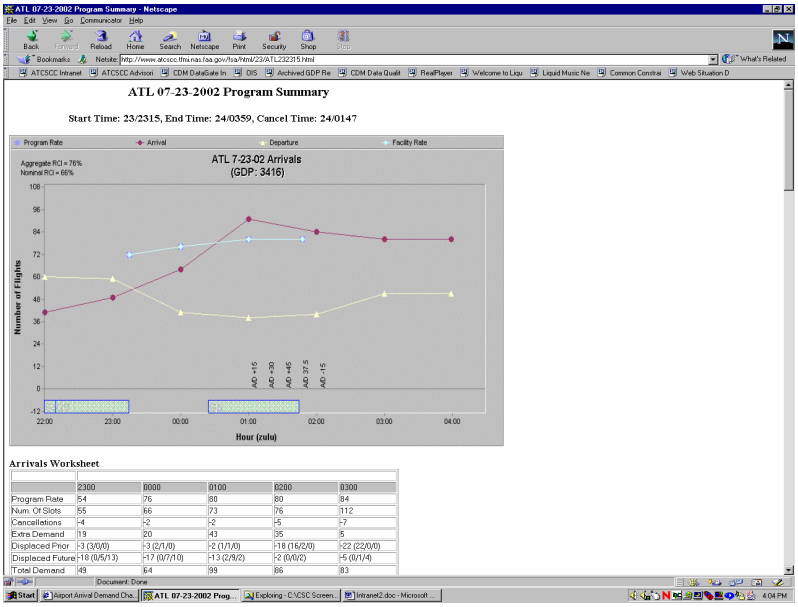


Exhibit 6-25. Example Program Summary published on the QA pages

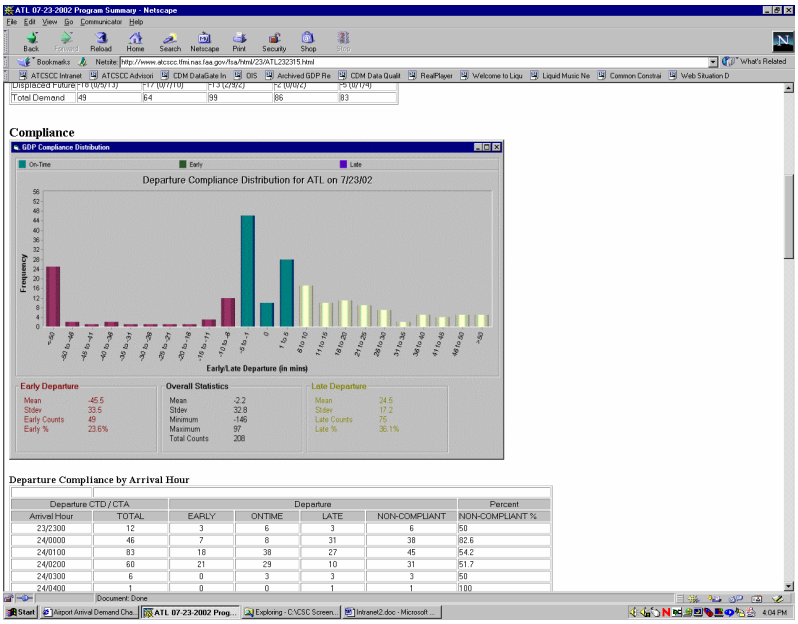


Exhibit 6-26. Example Compliance Data published on the QA pages

6.1.1.2.29 Training

The ATCSCC Intranet web site provides access to seven topic areas, one of which is "Training". The Training section of the web site is a gateway to information related to the continued professional development of AT personnel involved in national ATM activities and for access to training resources. In addition to the FAA Training Academy web site link, this web page summarizes ATCSCC internal training activities consisting of monthly proficiency training, FSM training, National Traffic Management Log (NTML) system administrator training, and Lotus Notes training. Appropriate links to internal training materials and information are provided.

6.1.1.2.30 What's New

The ATCSCC Intranet web site provides access to seven topic areas, one of which is "What's New". The "What's New" section of the web site outlines all changes and additions to the ATCSCC Intranet web site. Information is presented in reverse chronological order, i.e., the most recent information is displayed first.

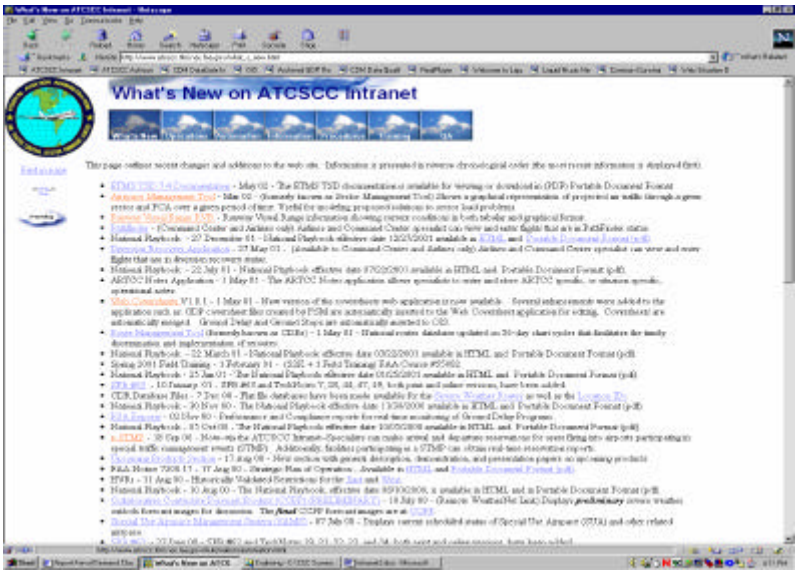


Exhibit 6-27. What's New Summary Page

6.1.1.3 Interfaces

The interfaces for the ATCSCC Intranet web site are specific to the products and information available on the site. This information is documented in the sections for each of the available products / information.

6.1.1.4 Data Sources

The data sources for the ATCSCC Intranet web site are specific to the products and information available on the site. This information is documented in the sections for each of the available products / information.

6.1.1.5 Outputs

The outputs for the ATCSCC Intranet web site are specific to the products and information available on the site. This information is documented in the sections for each of the available products / information. In general, outputs are provided via the web-based interface.

6.1.1.6 Reference Sources

- *ETMS Airspace Management Tool Version 7.09 Training Document*, ETMS-SYS-TRN-003, Draft Document Version 1.0, Kenrob and Associates, Inc.
- *ATCSCC Intranet web site,* http://www.atcscc.faa.gov
- *FAA Order 7450.1 Special Use Airspace Management System*

- *FAA Order 7610.4J Special Military Operations;* July 12, 2001

6.1.1.7 Miscellaneous

Version No: As of October 2002

Development Languages: HTML, Perl, CGI script, Java script

Platform: Windows 9x/NT/2000

COTS Products Used: Oracle

Software Maintenance Organization: Kenrob and Associates is currently the contractor who updates the information categories on the web site and maintains the website in general. Updates to products which display or provide information to the ATCSCC Intranet website are the responsibilities of the developers of the individual products.

6.1.2 Common Constraint Situation Display (CCSD)

6.1.2.1 Overview

The Common Constraint Situation Display (CCSD) is a Web-based product used by the airlines to view the same traffic demand and constraint information as FAA traffic managers use. It provides the airlines with information about conditions and constraints in the NAS, such as congested airports or overloaded airspace. The CCSD allows the FAA and the airlines to attain a common situational awareness of the problems they face and to facilitate effective, collaborative problem solving.

The CCSD provides TSD-like displays and functions via a PC and a standard web browser. It displays the ETMS predictions of sector loading and capacity by providing the following:

- Graphical alerts (icons) and text lists that display flights which contribute to the alert
- Graphical overlays of airports, sectors, Flight Information Regions, NAVAIDs, ARTCCs, and SUAs
- Graphical displays of any traffic FCA that the FAA has made public.

Airlines that participate in the FAA's CDM program can access the CCSD through CDMNet or through the ATCSCC Intranet.

6.1.2.2 Functions

The CCSD provides a scaled-down set of WSD capabilities. Refer to Section 6.1.25 WSD for a description of WSD functions. The CCSD differs from the WSD in four ways.

1. Flight icons are not shown. This is left to the private sector ASDI vendors. However, flight lists and counts are available for alerted elements.
2. Detailed data on sensitive flights (e.g., military flights) is not provided.
3. Some of the weather products (e.g., lightning) are not provided due to prohibitive licensing costs.
4. Users are not permitted to update ETMS data (e.g., capacities, GA estimates).

6.1.2.3 Interfaces

The CCSD provides a web-based GUI for user interaction. All other CCSD interfaces are the same as the TSD interfaces. Refer to Section 6.1.23 TSD for a summary of the interfaces.

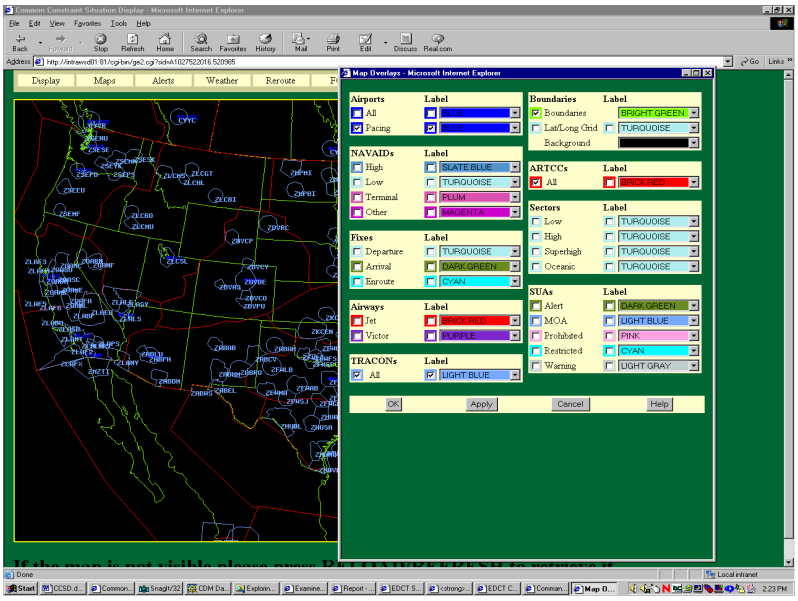


Exhibit 6-28. CCSD Map Overlay Selection Screen

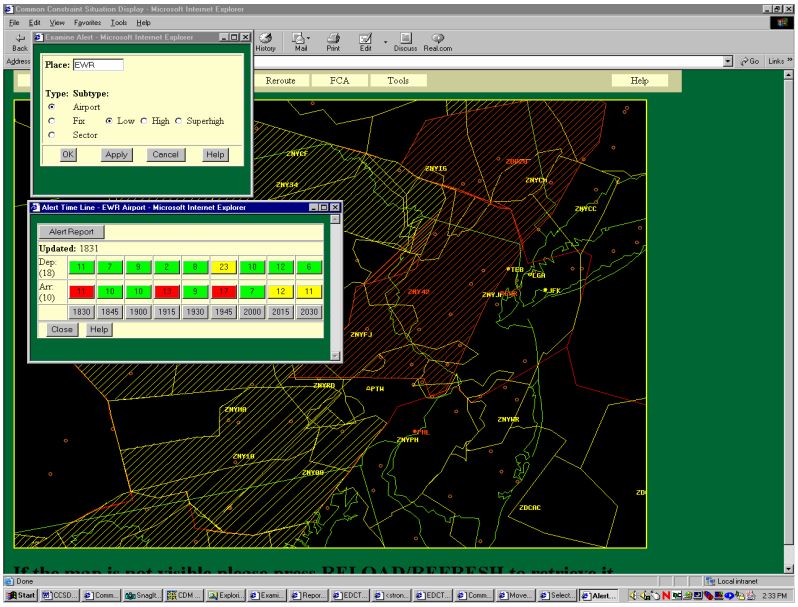


Exhibit 6-29. CCSD Alerts Report Example

6.1.2.4 Data Sources

The CCSD data sources are the same as the TSD data sources. Not all weather data provided to TSD is sent to the CCSD as previously mentioned. CCSD does not list or display METARs, TAF, lightning, jet stream, or cloud tops. Refer to Section 6.1.23, TSD, for a summary of the data sources.

6.1.2.5 Outputs

The CCSD outputs are the same as the TSD outputs, with the exception of flight icons and ETMS data updates, which are filtered as previously described. Refer to Section 6.1.23 TSD for a summary of the outputs.

6.1.2.6 Reference Sources

- *Enhanced Traffic Management System (ETMS) Functional Description, Version 7.4, Report No. VNTSC-DTS56-TMS-002*, dated June, 2002 (Draft); Volpe National Transportation Systems Center, U.S. Department of Transportation, Cambridge, MA
- *Enhanced Traffic Management System (ETMS) Reference Manual, Version 7.4*, Report No. VNTSC-DTS56-TMS-004, dated May 2002; Volpe National Transportation Systems Center, U.S. Department of Transportation, Cambridge, MA
- TFM Infrastructure and Operational Products web page, *http://www.faa.gov/aua/aua700/products/products.shtml*
- Common Constraint Situation Display Fact Sheet, *http://www.faa.gov/aua/aua700/tools/marketing/common.ppt*

6.1.2.7 Miscellaneous

Version No: CCSD Version 2.6

Development Languages: HTML, Perl, CGI script, Java script

Platform: Windows 9x / NT / 2K

COTS Products Used: Information not readily available

Software Maintenance Organization: Volpe

6.1.3 Computerized Voice Reservation System (CVRS)

6.1.3.1 Overview

The Air Traffic Control System Control Center (ATCSCC) has a process, the Enhanced Computerized Voice Reservation System (e-CVRS), which allows pilots to make reservations for High Density Traffic Airports (HDTA).

Pilots of non-scheduled IFR flights wanting to fly into certain High Density Traffic Airports (HDTA) are required to make arrival and departure reservations for slot allocations prior to entering/departing those congested airspaces. A non-scheduled flight is categorized as carrier, commercial, or other, and is any flight that is not listed in the OAG. High density airspaces currently include JFK, DCA, and LGA terminal areas. Chicago (ORD) was recently dropped from the HDTA list, and HDTA reservations are not required at EWR any longer. Reservations are only required during certain hours for each HDTA airport. Currently those hours are as follows, but these could be changed at any time: DCA - 6 AM to 11:59 PM (LOCAL), LGA - 6 AM to 11:59 PM (LOCAL), JFK - 3 PM to 7:59 PM (LOCAL).

The CVRS application allows users to request, confirm, update, and cancel a reservation online for an airport, date and time slot. A reservation or a slot reservation approval number is not an ATC clearance, nor does it constitute the filing of a flight plan. Pilots must still file flight plans prior to departure.

Users can make reservations in one of three ways: by calling the ARO (the functions of which are currently executed by the TCA position at the ATCSCC), using the touchtone phone reservation number, or by using the Internet web-based CVRS application accessed via www.fly.faa.gov/ecvrs/index.html. Users are restricted to a maximum of two transactions per phone call or web session.

Requests for IFR reservations are accepted starting 72 hours prior to the proposed time or operation at the affected airport. There are no exceptions for weekends and holidays. The advisory circular, AC 93-1 Reservations for Unscheduled Operations at High Density Traffic Airports, describes who needs to make a reservation at an HDTA airport. It is available in Adobe format on the www.fly.faa.gov/ecvrs site, as is an online e-CVRS help document.

The e-CVRS web pages support usage by the following browsers:

- Netscape 4.0 or newer
- Internet Explorer 5.0 or newer
- AOL 5.0 or newer
- Mozilla 1.0 or newer.

Users are directed to contact the ATCSCC ARO specialist (the TCA position) if they have questions or problems with the e-CVRS system or a particular reservation.

6.1.3.2 Functions

The e-CVRS application design and functionality is consistent with that of the e-STMP application (see Section 6.1.8).

There are two applications that support the current HDTA process:

- e-CVRS - allows users to register, reserve time slots, and update and cancel time slot reservations at an airport designated as an HDTA. This application has a touch-one telephone interface and an Internet web-based interface.
- HDTA Slot Administration Tool – allows the ARO Position specialist to change the number of slots available in a given hour.

Underlying these applications is an Oracle database (shared with e-STMP) that contains information about each registered e-CVRS user, each HDTA airport, and individual slot reservations. CVRS reservations are created and maintained via e-CVRS. The following subsections provide additional details for e-CVRS and the CVRS database administration components.

CVRS runs on a Linux server at the ATCSCC. e-CVRS was implemented on October 1, 2002. The e-CVRS application is available on both the Internet and the ATCSCC Intranet. Traffic managers at the ATCSCC (TCA position) access the e-CVRS on behalf of users without Internet or touch tone phone access.

The e-CVRS public website, accessible through the www.fly.faa.gov (ATCSCC) website, provides registration and log in, user help and general HDTA reservation requirement information, as well as the following pages directly associated with making, amending, or canceling a reservation at an HDTA airport:

- Make Reservation
- Confirm Reservation
- Change Reservation Date/Time
- Update Reservation
- Cancel Reservation.

6.1.3.2.1 CVRS User Reservation Component

Registration. Only registered users are permitted access to the e-CVRS reservation system. All individuals using the e-CVRS web reservation system are required to complete a one-time registration form, providing their full name, e-mail address, a password, and (optionally) company name. A confirmation number is sent by e-mail address and must be used to confirm the registration before the user can log in to make a reservation. The information is stored in the CVRS/STMP Oracle database to authenticate users on subsequent visits to the web site.

Login. To use the e-CVRS web reservation system, the user must log on with the User ID (e-mail address) and password used during registration. This site also requires 'cookies' to be enabled in the web browser in order to access e-CVRS reservation functions.

A change password function is provided to allow users to amend their password from time to time.

Making a Reservation. Once logged in, reservations can be made by providing the following information: Type of Request (either arrival or departure), the HDTA airport name (selected from the drop down list), date of reservation request (drop down list) time of request, tail number of the aircraft, and (optionally) origin / destination airport and / or aircraft type.

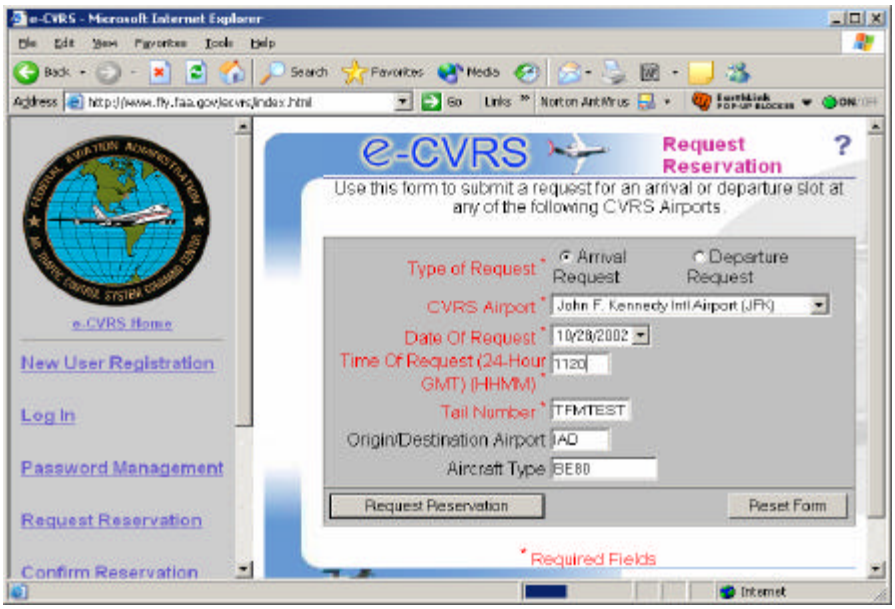


Exhibit 6-30. Making a Reservation using e-CVRS

ZULU time is used for reservations. e-CVRS internally recognizes both Zulu and local time since the database is tied to local airport time. It automatically adjusts to and from Daylight Savings Time as necessary.

Only a limited number of arrival and departure reservations may be available at an HDTA airport. The system searches for an available slot time before, during, and after the time requested. If it is unable to find a slot, it responds (verbally or via the terminal window) that a slot time is not available close to, or at, the time requested. It then requests that the user make another selection.

If the requested arrival / departure time slot is unavailable, the e-CVRS system displays the nearest available times a reservation slot is open – one time before and one time after the requested time.

If a reservation is not required for the date and hour selected, CVRS informs the user that a reservation is not required.

If the reservation is approved, CVRS provides a reservation number to the user.

Confirming a Reservation. Confirming a reservation is not required. Once a reservation is made, it is final unless cancelled by the person making the reservation. The confirmation form on the e-CVRS web site allows reservations made by either the touch-tone phone system or the web interface to be confirmed. The user must provide the reservation number, select the HDTA airport and enter the tail number of the flight with the particular reservation.

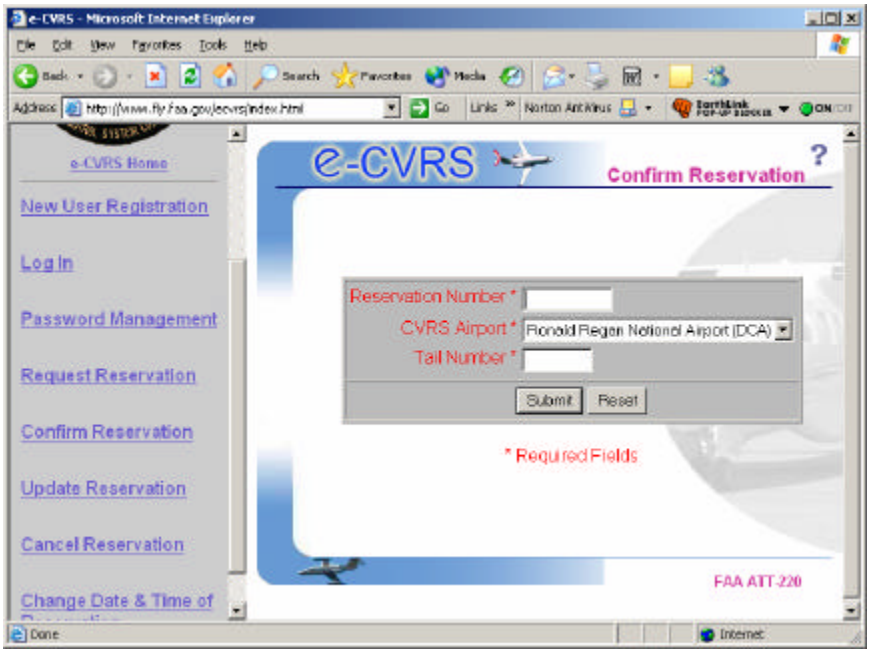


Exhibit 6-31. Confirming a Reservation using e-CVRS

Updating a Reservation. The Update Reservation function is used for changing Aircraft Type, Aircraft Tail Number, or the Origin/Destination Airport. Any or all of these items may be changed from the same page. If other changes (i.e., to the date or time of the reservation) are needed, the Changing Date and Time of Reservation form is used. As shown by the screen capture below, the user must provide the previous reservation number, select the HDTA airport for which the reservation was made and provide the original tail number, and then provide new information to replace one or all of the origin/destination airport, tail number or aircraft type fields.

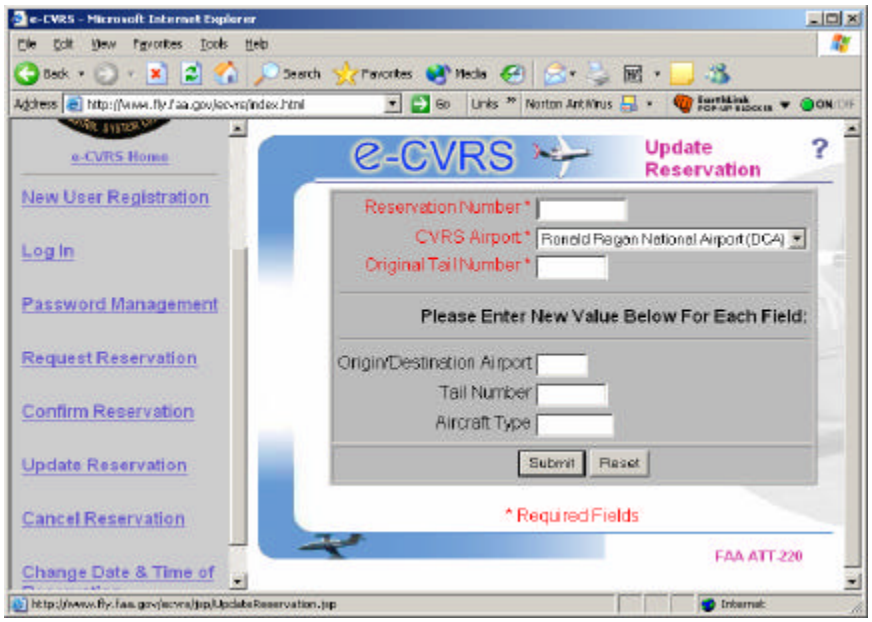


Exhibit 6-32. Updating a Reservation using e-CVRS

Canceling a Reservation. The Cancel Reservation function is used to cancel a reservation for an HDTA airport. To ensure security, all fields (shown below on the screen capture) on the Cancel Reservation form are required. If a field is left blank, no information is returned to the user.

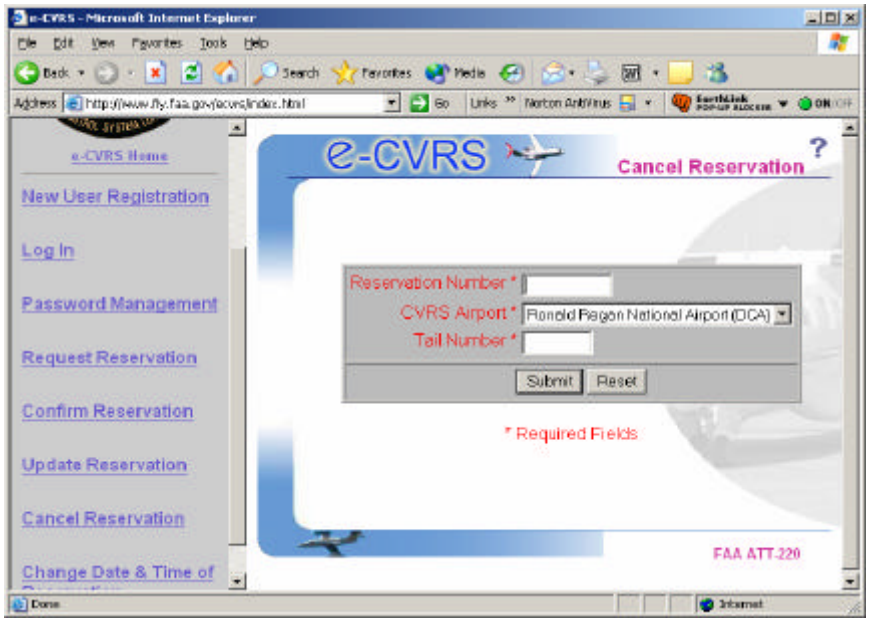


Exhibit 6-33. Canceling a Reservation using e-CVRS

Changing Reservation Date/Time. This function is used to change the date and time of a reservation for an airport. To ensure security, all fields (as shown below on the screen capture) on the Change Reservation Date form are required. If a field is left blank, no information is returned to the user.

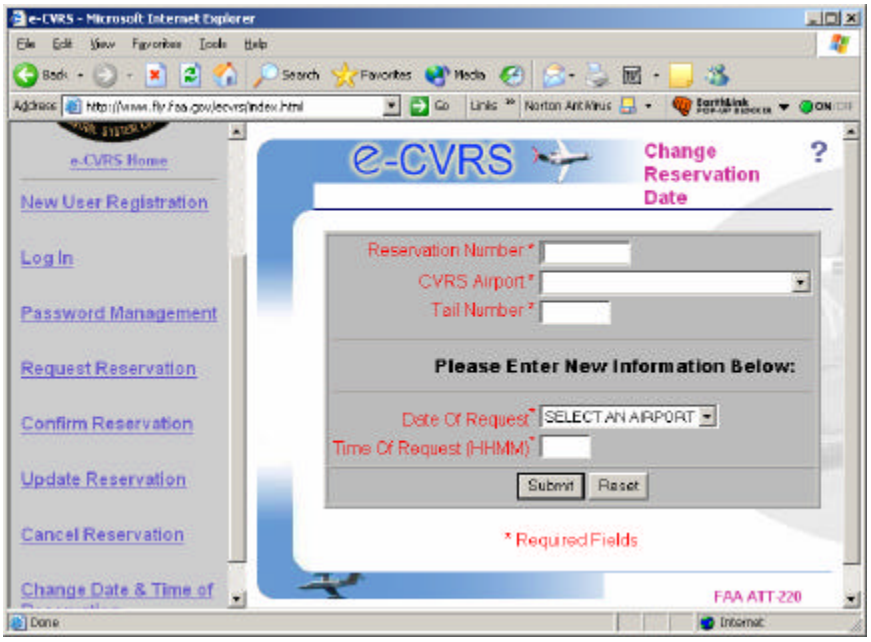


Exhibit 6-34. Changing Reservation Date/Time using e-CVRS

6.1.3.2.2 e-CVRS Administration Components

The e-CVRS Administration components allow ATCSCC specialists to perform the following tasks:

- Use a web browser to obtain on-demand reports depicting status of slots, and detailed information on reservations.
- Create, confirm, cancel and force a slot reservation.
- Revise the number of slots available for any designated HDTA airport during any given hour using a separate Windows-like Slot Administration interface.

6.1.3.2.3 e-CVRS Slot Administration Tool

ATCSCC specialists are required to log in with their operating initials to use the e-CVRS Slot Administration application, shown below. This application allows specialists to select the airport and date/time for which to modify slots, change one or both of the slot flag or the total number of slots, copy and paste, review, cancel changes, and save changes. All slots are flagged as Normal Slot, No Reservation Required, or No Reservation Allowed. The system locks the

application for a maximum of 60 minutes while any one specialist is working on revisions to slot changes so duplicate entries cannot be made.

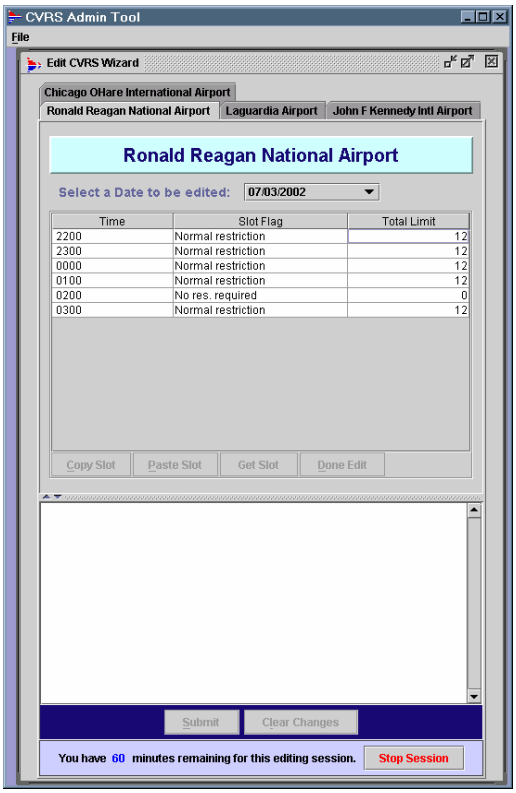


Exhibit 6-35. e-CVRS Slot Administration Tool

6.1.3.3 Interfaces

e-CVRS does not interface with any other automated system, although it shares the underlying Oracle database with e-STMP.

6.1.3.4 Data Sources

All CVRS data is entered manually via the Internet or touch tone phone.

6.1.3.5 Outputs

The CVRS administration components create, modify, and cancel entries in the CVRS database.

Authorized CVRS administrators can view reports via a web-browser interface.

6.1.3.6 Reference Sources

- *e-CVRS Communications/Database Specification, V1.01, 03/05/2002*

- *e-CVRS Slots Administration Application Specification, Kenrob and Associates, 09/05/2002*
- *Advisory Circular 93-1, Reservations for Unscheduled Operations at High Density Traffic Airports, U.S. Department of Transportation, Federal Aviation Administration, October 1, 2002*

6.1.3.7 Miscellaneous

Version No: N/A

Development Languages: Java Server Pages JSP, Java Servlets, Java Enterprise Beans, PL/SQL, and client Java script.

Platform: Linux

COTS Products Used: Oracle, iPlanet 4.x web server.

Software Maintenance Organization: Kenrob and Associates

6.1.4 Delay Manager (DMGR)

6.1.4.1 Overview

Delay Manager, an ETMS subsystem, simulates and evaluates the effects of controlling arriving flights for any selected airport. This function allows the TM Specialist to evaluate the effects of implementing a ground stop program, to monitor the status of a ground delay program, and to simulate the releasing of flights from a ground stop or ground delay program. The Delay Manager accesses flight data through requests to the ETMS List Server.

Delay Manager provides a continually updated picture of a selected airport's arrival situation through the display of bar charts and list reports. DMGR allows TM Specialists to set up different models for managing arrivals at the airport and to see the effects of decisions before implementing them. It allows a TM Specialist to monitor the status of a ground delay program, to simulate the releasing of flights from a ground stop or ground delay program, and to evaluate the effects of implementing a ground stop program.

DMGR is an FSM alternative developed prior to FSM. Its bar chart display is similar to, but not identical to FSM's. FSM functions include all Delay Manager functions, and go beyond Delay Manager's capabilities. For this reason, Delay Manager is no longer being tested or upgraded. The Audit team did not see Delay Manager in use at any visited site.

6.1.4.2 Functions

DMGR enables the Traffic Management Specialist to perform the following functions:

- Monitor an Estimated Departure Clearance Time (EDCT) Program - DMGR allows a Traffic Management Specialist to monitor whether the number of predicted arrivals at a controlled airport is running above or below the desired arrival capacity a specialist is trying to achieve. Delay Manager provides a chart, automatically updated every 5 minutes, of predicted arrivals in 15-minute time intervals. A specialist can compare the predicted arrivals from DMGR with the current capacity value (CAPS value) obtained from ETMS, or with a manually entered Airport Acceptance Rate (AAR).
- Modify an EDCT Program - If an EDCT program is not producing satisfactory results or if an airport's arrival rate changes, Delay Manager lets a Traffic Management Specialist experiment with different ways of releasing flights from the program to resolve the problem. The user specifies what flights to release (by departure airport, center, or tier) and when to release them, and Delay Manager simulates the result on the bar chart.
- Manage a Ground Stop - If a specialist wants to initiate a ground stop or already has one implemented that needs to be removed, DMGR helps to figure out the best way to manage it. Traffic Management Specialists can specify which flights to stop, which flights to release, and when to stop or release, and Delay Manager simulates the result.

The Delay Manager Setup capability is used to provide user entered scenario data for modeling ground stops and GDPs (EDCT releases).

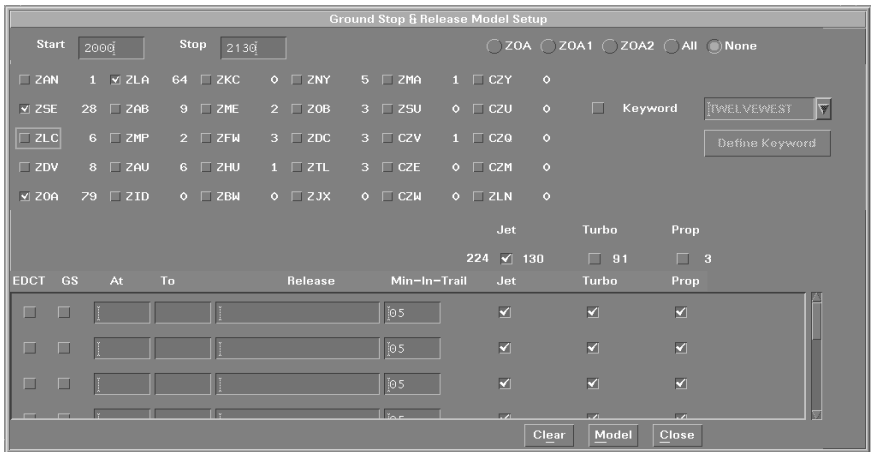


Exhibit 6-36. Delay Manager – Setup Form for Ground Stop and EDCT Release Modeling

6.1.4.3 Interfaces

DMGR interfaces with two other ETMS processes – List Server and the Traffic Database (TDB). Timers automatically trigger both of these interfaces every 5 minutes. List Server enables users to generate flight reports, fix loading reports, flight plan reports, arrival delay prediction reports, and time verification reports. DMGR sends a data request to List Server and the List Server responds by sending a report, a warning, or an error. The TDB monitors air traffic demands in real time for a large number of NAS elements (e.g. airports, fixes, and sectors). DMGR sends an airport arrival capacity request to the TDB, and upon receipt of this request, the TDB transmits an airport arrival capacity response to DMGR. This airport arrival capacity response contains flight capacity counts per time interval.

6.1.4.4 Data Sources

ETMS processes / databases provide three sorts of input to DMGR in the form of:

- Airport Arrival Capacity from the TDB, requested at initialization or at specialist request for a change to a new airport
- LSTNET reports, obtained at initialization and updated every 5 minutes thereafter
- Requests for a s0 level statistics report, which contains system administration diagnostics information, through net.mail.

Other inputs are user inputs that the GUI interface elicits (e.g. start and stop times, airport) in order to show a modeled version of what the arrival load could be on an airport if a controller simulates issuing delays on incoming aircraft.

6.1.4.5 Outputs

Delay Manager is primarily a GUI display, which outputs two different bar charts and reports to a user. The two bar charts are the original bar chart as if there were no delays issued and the modeled (simulated) bar chart. The modeled bar chart allows a specialist to visually determine whether his simulated delays had a positive effect (more even arrivals in each of the 15-minute interval arrival buckets) on arriving air traffic at the selected airport. The specialist can also request a Master Flight List by clicking on List at the bottom of the Delay Manager bar chart. Additionally, the specialist can click on a specific bar within the bar chart and see a report listing the flights comprising the demand for the 15-minute interval. The specialist can either choose M for the modeled report or O for the original bar chart. These reports can be sorted, according to specialist preference, by either the ETA (Estimated Time of Arrival) or by the departure center. All GUI displays can also be output to a printer.

DMGR provides the following outputs:

- Graphical bar charts
- Flight list reports

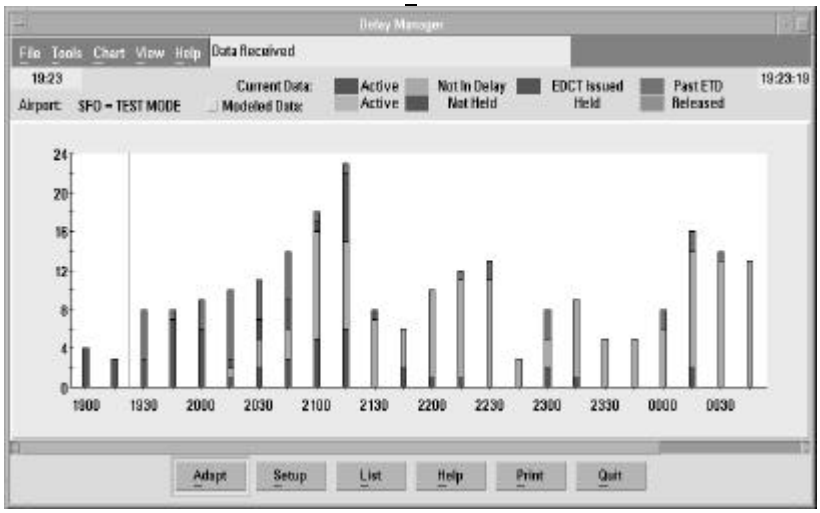


Exhibit 6-37. Delay Manager Example Bar Chart

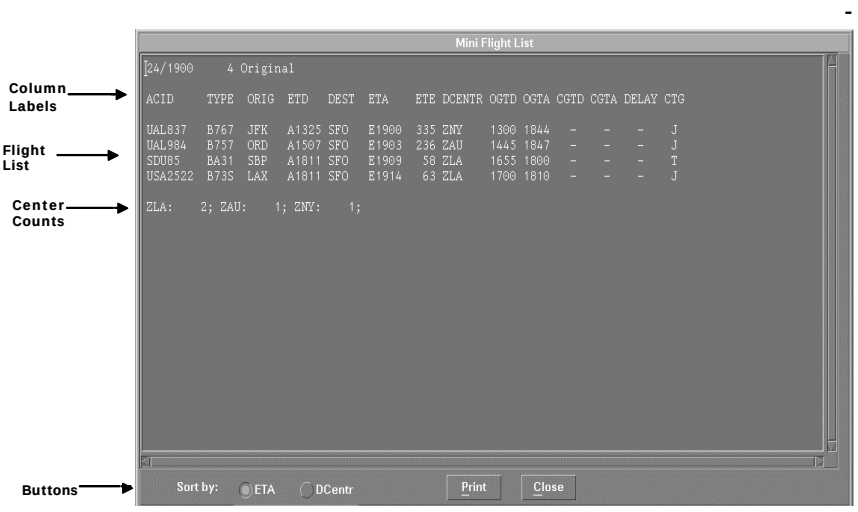


Exhibit 6-38. Delay Manager Flight List Display

6.1.4.6 Reference Sources

- *Enhanced Traffic Management System (ETMS) Functional Description, Version 7.4, Report No. VNTSC-DTS56-TMS-002*, dated June, 2002 (Draft); Volpe National Transportation Systems Center, U.S. Department of Transportation, Cambridge, MA
- Enhanced Traffic Management System (ETMS) Reference Manual, Version 7.4, Report No. VNTSC-DTS56-TMS-004, May 2002; Volpe National Transportation Systems Center, U.S. Department of Transportation, Cambridge, MA
- Draft ETMS System Design Document, Version 6.0, Report No. Volpe Center-DTS56-TMS-008, March 1999; Volpe National Transportation Systems Center, U.S. Department of Transportation, Cambridge, MA

6.1.4.7 Miscellaneous

Version No: ETMS 7.5

Development Languages: C

Platform: HP-UX 11.0, Red Hat Linux 7.3

COTS Products Used: None

Software Maintenance Organization: Computer Sciences Corporation

6.1.5 Departure Spacing Program (DSP)

6.1.5.1 Overview

The Departure Spacing Program (DSP) is currently being developed as a proof-of-concept prototype for implementation across the NAS. DSP evaluates aircraft departure flight plans at participating airports, models projected aircraft demand at departure resources such as first and second departure fixes, and provides windows of departure times to controllers.

DSP provides automated tools to help traffic managers manage sector workload and regulate traffic by ensuring that the number of aircraft controlled at any one time does not exceed a predefined level of system capacity. The DSP regulates departures through the scheduling of departure releases at selected airports so the resulting demand at departure flow fixes does not compromise prevailing fix flow rates. Departure schedules calculated by the DSP coordinate the release of departures from multiple airports, producing a level of demand that can be managed by controllers as departure traffic converges on common departure flow fixes.

DSP is in use at the New York ARTCC, New York and Philadelphia TRACONs, and their associated 7 larger airports with departure strips displayed for 93 satellite airports. Satellite airports do not have DSP equipment installed in their towers. The 7 larger airports with DSP are:

1. John F. Kennedy (JFK)
2. LaGuardia (LGA)
3. Newark (EWR)
4. Philadelphia (PHL)
5. Teterboro (TEB)
6. Long Island Mac Arthur (ISP)
7. White Plains (Westchester County) (HPN)

DSP has now also been installed at the ATCSCC so TM Specialists in the East area can monitor/assess traffic loading and routing issues in the congested Northeast departure corridor, especially during severe weather events. DSP is expected to be operational as well in the ZBW and ZDC facilities in the near future, providing a common source of departure data to all major facilities in the heavily congested northeastern US corridor airspace.

DSP is of special importance during severe weather situations, when avoidance of rapidly developing weather requires re-routes to be planned and implemented rapidly and on a large scale. DSP increases productivity during severe weather and other high-workload situations by replacing or streamlining cumbersome existing coordination processes. For example, DSP provides graphical user interfaces such as electronic flight departure strips, which eliminate paper strips, and near real-time electronic information exchange, which eliminates phone communications among ARTCC, TRACON, and tower traffic management specialists and controllers.

The DSP uses fix flow rates and time-period based flight count parameters to regulate sector controller workloads. These parameters control the total number of aircraft (per hour) cleared to a fix and the distribution of those aircraft over time. In this way, specialists can control the "bunching" of aircraft at a fix. The more bunching that occurs in the air, the more flexibility for aircraft movement on the ground.

Fix flow rates and other parameters are set on a per fix basis so that variations, such as sector complexity, weather, differing levels of traffic volume, may be accommodated. The System Status display also has provisions for manual adjustments that impact DSP scheduling. Scheduling priorities can be modified by changing the airport priority settings and by modifying the demand basis.

DSP airport departure schedules take into consideration

- Departures from multiple airports converging on common departure flow fixes
- Flights which have received Estimated Departure Clearance Times (EDCTs) from the ATCSCC to implement a national delay program
- Controlled Departure Times (CDTs)
- Imposed restrictions on departure flights by adjacent ARTCCs
- The number, departure status, and location of flights contending for the same runway
- Current airport conditions (for example, current airport runway configuration and departure rates)
- Airport priority
- Fix Flow rates

The DSP also automatically monitors overall system performance and adjusts the runway schedules and suggested flight times based on changes in:

- Departure demand at each DSP airport
- Traffic demand in the departure flow fix environment
- Airport conditions (system delays, rate changes, and configuration changes)

Miles-In-Trail (MIT) restrictions may occasionally be imposed with respect to aircraft departing airports within one ARTCC for arrival at other specific airports. The DSP, using the arrival airports as discriminators, is capable of metering the departure ARTCC's traffic to the borders of the arrival airport's ARTCC by adapting "gates" at the borders and imposing gate flow rates. When these parameters are properly set, aircraft destined for an airport with an MIT restriction will be flowed in number and distribution, at the applicable center border, so that they can be manipulated by the sector controller to meet the MIT restriction imposed by the adjacent center.

DSP system requirements continue to be refined and implemented based on user input, as approved by the FAA.

6.1.5.2 Functions

See the Outputs subsection below for a description of DSP user functionality.

DSP provides the following primary functional capabilities:

- Acquiring eligible flight plans
- Sequencing aircraft for departure
- Removing aircraft from consideration after they have crossed their DSP departure flow fixes
- Coordinating multiple airport and runway operations
- Providing a means by which a Traffic Management Coordinator (TMC) can vary DSP parameters to provide a smooth flow of departure traffic

DSP system functions are divided into two primary capabilities: Scheduler and Database Management (DBMS). For further information on these system level functions, see the DSP Principle Of Operations document dated November 12, 2002.

6.1.5.3 Interfaces

DSP's sole interface is with the Host computer system, from which it gets its flight plan data. DSP acquires its primary data (FZ messages) via the GPO interface. Supplementary data acquired via a printer tap in the PIT area at ZNY supplies display data only.

At the 'PIT' sector in ZNY, a KVDT emulation is installed on the DSP display to allow controllers to quickly cut and paste messages from DSP to be sent back to the Host.

The DSP System Operational Overview diagram below shows the DSP supported functions and the communication flow.

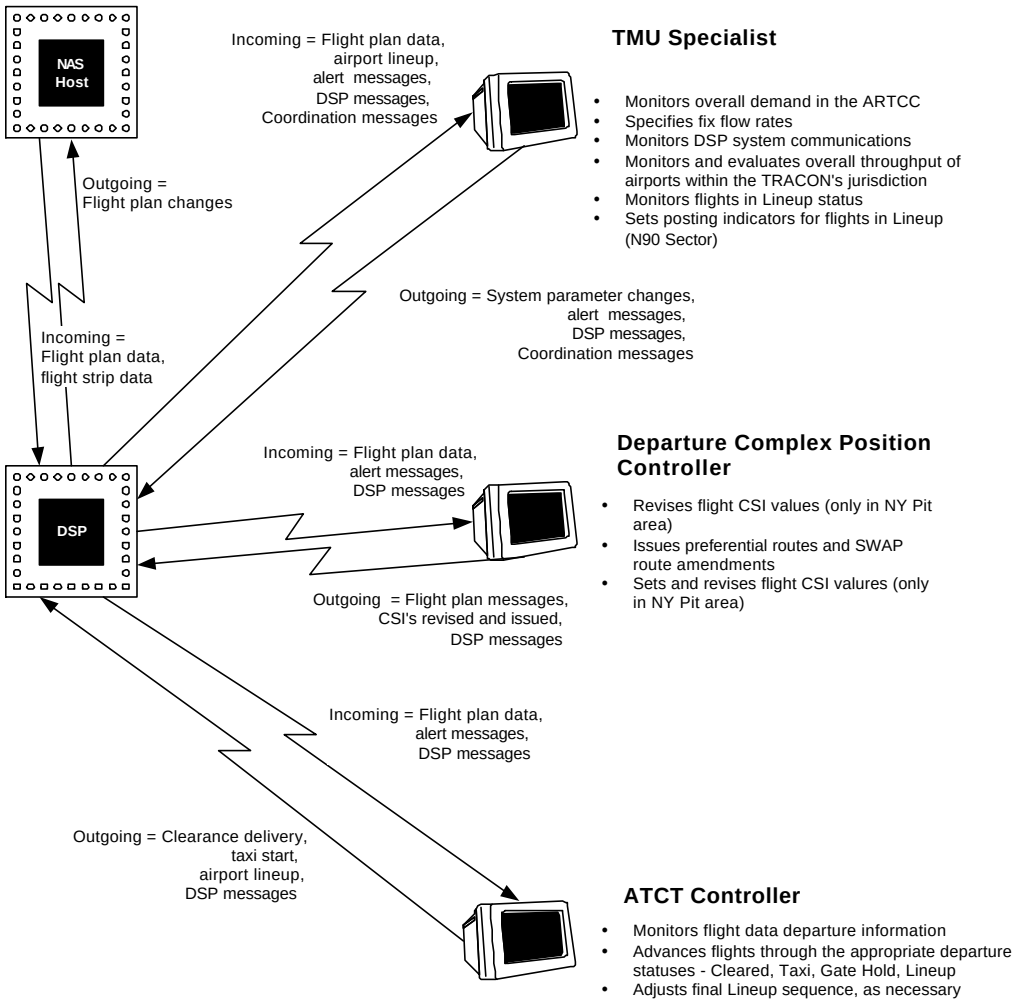


Exhibit 6-39. DSP System Operational Overview

6.1.5.4 Data Sources

The primary data source for DSP is NAS flight plan data (FZ messages) obtained from the Host computer system via a one-way GPO interface. Supplementary, display-only, data is acquired via the PIT flight strip printer.

The flight information is determined from real-time NAS "Z" (and AF) messages. These messages include Flight Plans (FZ), Amendments (AZ and AF), Beacon Codes (BZ), Cancellations (RZ), Estimated Departures Clearance Times (EDCTs) (CT), and Departures (DZ).

Users can manually cancel or modify a flight's Estimated Departure Clearance Time, and manipulate how flights are scheduled.

The Requested Altitude and FZ Route fields on the DSP Flight Information pop-up window for a selected flight are dynamically updated based on DSP data received via the FZ message over the one-way GPO interface from NAS.

6.1.5.5 Outputs

DSP displays, controls, and functions are different for each of the three user groups: TMU specialists in the ARTCC/TRACON, controllers in the departure complex position and controllers in the tower. There is substantial similarity between the first two groups. Rapid prototyping techniques used in developing DSP user interfaces means that these can be changed quickly and, therefore, screen captures provided here may vary slightly from those in actual use at the sites at any time. The focus of the following discussion is on TMU capabilities and displays.

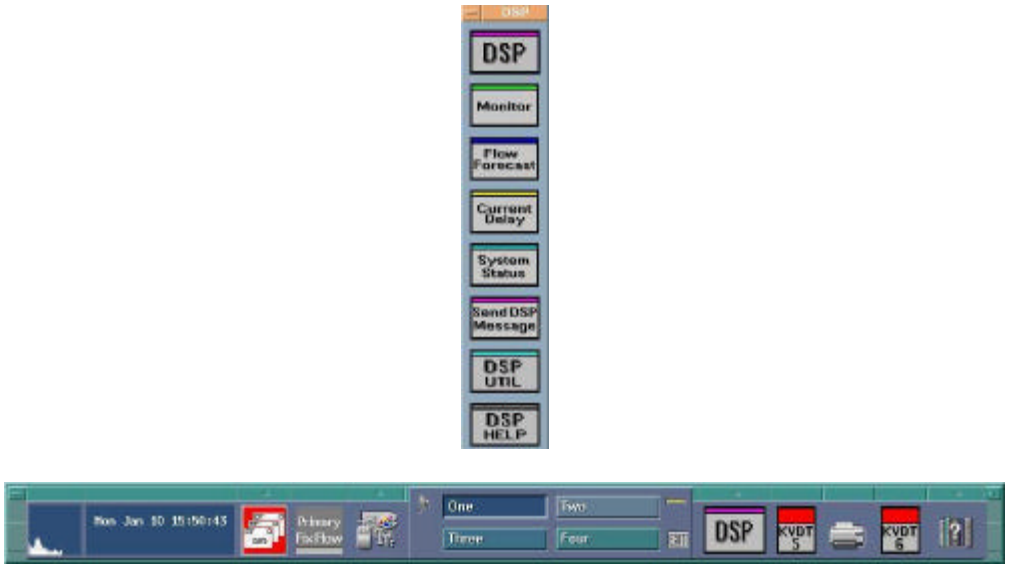


Exhibit 6-40. Typical ARTCC/TRACON TMU DSP Control Panel

The ARTCC/TRACON displays provide DSP system control functions. The TMU specialist has the capability to monitor departure schedules, airport configurations, and traffic demand at adapted DSP departure fixes. See Exhibit 6-40. Typical ARTCC/TRACON TMU DSP Control Panel

The Monitor Display provides detailed flight information for flights departing a specific DSP airport or crossing an adapted DSP fix. The following are provided:

- The Airport Monitor gives the user the capability of viewing the rate(s) for each departure runway at the selected airport.
- Both the Fix Monitor and the Gate Monitor give the ARTCC TMU Specialist the capability to add or delete a flight to the Fix Schedule when the flight's departure point is not a DSP-adapted airport. See Exhibit 6-41. Fix Monitor Display
- The Gate Monitor allows the user to view a pop-up list of all the fixes adapted for the selected gate. (The DSP provides this list for reference purposes.) . Currently, up to 1200 flights are displayable on the Gates Monitor display.
- Flow Forecast Display – Provides a geographical display of the number of aircraft projected to cross each DSP departure flow fix for the next 1-hour period, in 15-minute increments. This display also provides information on any fix flow rate restrictions currently in effect, and information on any pre-adapted restriction plans, as shown in Exhibit 6-42. Primary Flow Forecast Display.
- Current Delay Display – Provides current and historical ground delay information, in minutes, for any DSP airport or flight.
- System Status Display – Provides the current values of the DSP system parameters, and the communication status for each participating DSP Tower communicating with the TMU and the departure complex.

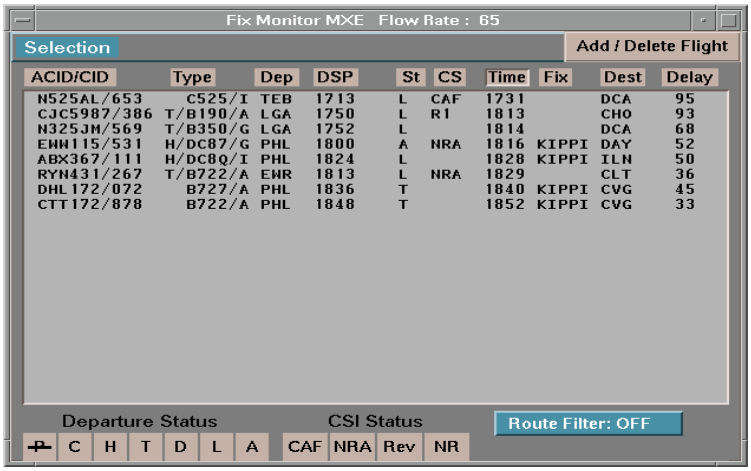


Exhibit 6-41. Fix Monitor Display

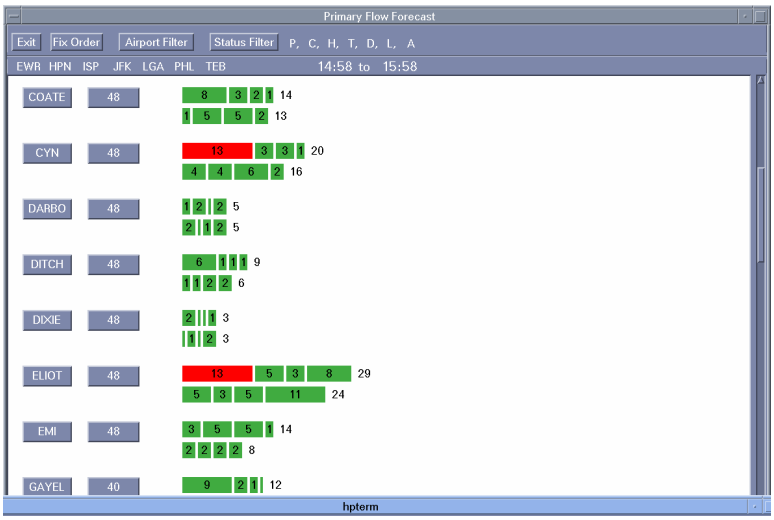


Exhibit 6-42. Primary Flow Forecast Display

Controls on these monitors also allow the user to access a DSP Flight Information pop-up window for a selected flight, as shown in Exhibit 6-43. Flight Information Pop Up Feature. The pop-up contains the ACID/CID for the selected flight, the requested altitude, and the FZ route. If a flight strip has been sent to the departure FSP for the flight, the flight strip will also be displayed.

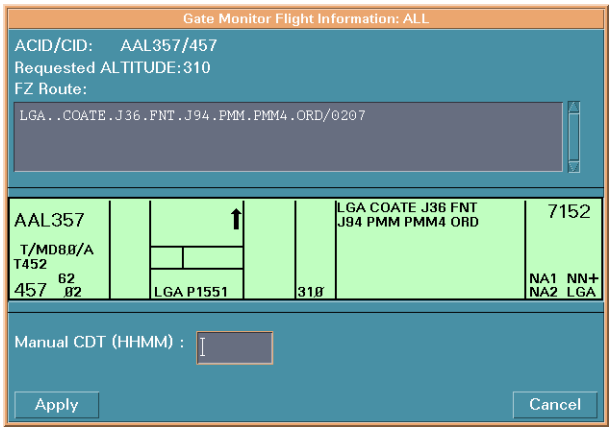


Exhibit 6-43. Flight Information Pop Up Feature

In addition to the above, departure complex position controllers have access to the Airport Lineup display. This display provides the flight departure lineup at each airport as well as airport configuration information.

Tower controllers, traffic management specialists, and supervisors are provided with suggested departure sequences for aircraft departing a single runway or a complex of runways. The ATCT device display can be configured to contain five control windows:

- Proposed – Contains flight list entries for proposed flights with a departure status of "Proposed." For each flight list entry, this control window displays the flight identifier.
- Cleared – Contains flight information for flight that have received their route clearances. For each flight list entry, this window displays the flight identifier, DSP generated departure time, and DSP assigned runway.
- Taxi – Contains flight information for flight currently taxiing towards their departure runway. For each flight list entry, this window displays the flight identifier, aircraft type or destination, DSP generated departure time, and DSP assigned departure runway.
- Final Lineup – Contains flight information for flights that have completed their taxi and are waiting clearance for takeoff. For each flight list entry, this window displays the flight identifier, aircraft type or destination, DSP generated departure time, and DSP assigned departure runway.
- Gate Hold – Contains flight information for flight currently in a gate hold situation. For each flight list entry, this window displays the flight identifier, accumulated gate hold time, and DSP assigned departure runway.

6.1.5.6 Reference Sources

- *Functional Baseline Specifications for DSP, dated TBD*; Computer Sciences Corporation, Egg Harbor Township, NY
- *Principles of Operation (POO) for DSP*, dated July 15, 2002; Computer Sciences Corporation, Egg Harbor Township, NY
- *Software Development Plan (SDP) for DSP*, dated July 17, 2002; Computer Sciences Corporation, Egg Harbor Township, NY

6.1.5.7 Miscellaneous

Version No: Release 14 Patch C

Development Languages: C

Platform: HP servers and workstations, touch screen and flat panel monitors, CRTs

COTS Products Used: Oracle SQL, HP-UX 10.20, I/O Concepts 5.51, I/O Concepts 9.1.8

Software Maintenance Organization: Computer Sciences Corporation (CSC)

6.1.6 Diversion Recovery Web Page (DRWP)

6.1.6.1 Overview

A diversion is a flight that is required to land at other than its original destination for reasons beyond the control of the pilot/airline, e.g., periods of significant weather. Diversion recovery is an initiative orchestrated by the ATCSCC and system users to minimize the impact of system disruption. Diversion recovery is utilized during and after periods of significant weather or other phenomena that has adversely impacted the system resulting in flight diversions. The goal of the diversion recovery initiative is to ensure that flights which have already been penalized by having to divert to another airport, do not receive additional penalties or delays. Flights identified for diversion recovery receive priority handling over other flights from their point of departure.

The Diversion Recovery Web Page (DRWP) provides the FAA and the airlines with an automated, real-time, interactive traffic management decision support system for identifying, monitoring, and tracking diverted flights through their recovery process. The web page uses flight information from the ETMS and manual FAA and airline input to identify diverted flights and coordinate efficient recovery actions. The web page is available on the ATCSCC Intranet web site.

The DRWP shows FAA users the diversion recovery flights for which the NAS users have requested special handling, and it lets the NAS users know that the FAA is aware that special handling has been requested for these flights. This allows common situational awareness without phone calls.

The airline establishes a diverted flight on DRWP by entering “DVRSN” in field 11 of the flight plan or by manually entering the flight on the DRWP Add Flight Page. The following guidelines are used in diversion recovery procedures:

- A flight on the DRWP is requesting priority.
- "High" priority indicates the user's preference within the airline. There are only 2 priorities, “High” and “-“. It is intended that priorities be used in the following way.

  For flights that are diverted to a particular airport, an airline can indicate the priorities of those flights with the ETD, which is set to the P-time in the flight plan plus 10 minutes. The goal is that those flights will depart in the order specified in the ETD field (see item 3 below). The priority for these flights is “-“. For flights diverted to multiple airports, the priority can be set to “High” to indicate which of them have priority among the airline’s flights.
- A company with multiple flights at the same airport with the same destination will be prioritized based on their proposed times.
- The user submitted preferred priorities may be modified where necessary to maintain the efficiency of the system.

6.1.6.2 Functions

The DRWP consists of the following pages: Main Page, Comment Page, Add Flight Page, Status Page, Printer Friendly Page, and Counts Page. At the bottom of each of the pages is the Control Panel. The Control Panel allows a user to control what data appears on the Main Page, to control how it is sorted and filtered, and to move among the various pages.

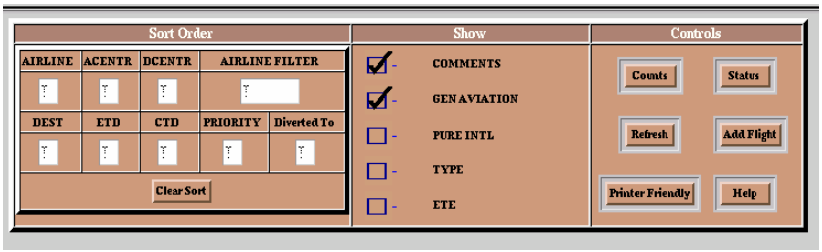


Exhibit 6-44. DRWP Control Panel

Main Page. The Main Page shows the basic information about the diversion recovery flights. There are two situations that cause a flight to be placed on this page.

1. DVRSN Flights: An airline can file a flight plan with "DVRSN" if field 11. If ETMS detects "DVRSN" in field 11, it places the flight on this page with a priority of '-'. The data on the flight that is displayed on the page (including updates) is provided by ETMS, except that the NAS user has the option of changing the priority to 'High.'

2. Manually Entered Flights: If a NAS user has not provided the DVRSN entry in field 11, ETMS will not detect the flight, so the DRWP provides a means by which a user can manually add a flight that has been diverted. If an FAA or NAS user issues the Add Flight command via DRWP, a flight is added to this page. The priority is '-' unless the user explicitly indicates that the priority should be 'High.' The user that adds the flight provides the data. ETMS does not change or add to the data entered by the user. If the data on this flight changes, it is the responsibility of the user who entered the flight data to update it.

There are four situations that cause a flight to be removed from the DRWP Main Page.

1. If a DVRSN flight takes off, it is automatically removed. This option does not apply to manually added flights.

2. If a DVRSN flight is canceled, it is automatically removed unless it is a time-out cancel (see *Note* below), in which case it is left on the page for 2 hours after the ETD. This option does not apply to manually added flights.

   Note: The term "time-out cancel" needs explanation. If a flight for which a flight plan has been filed does not take off at the estimated time, ETMS initially assumes that it is late taking off, and ETMS pushes its take-off time later in time. Eventually, so much time passes that ETMS decides that the flight is not going to

fly, and ETMS marks this flight as a time-out cancel, and the flight is no longer included in the ETMS demand predictions. Currently, ETMS time-out cancels a flight if it fails to take off within ninety minutes of the estimated departure time provided in its flight plan. If a flight is known only from the OAG schedule, ETMS cancels it ten minutes after the ETD.

3. A user can manually delete any flight. To do this, the user clicks on the flight's call sign to go to the Comment Page and then clicks the Delete Flight button.

4. If a flight is still being displayed 2 hours after its ETD, it is automatically deleted. This is the DRWP default. The two-hour parameter is configurable and can be changed.

Comment Page. The Comment Page allows a user to enter explanatory comments about a flight, to see comments that have already been entered, or to change the priority of a flight. It allows the TCA at the ATCSCC to acknowledge that the flight has been seen and is receiving special handling. A user can delete a flight from the DRWP Main Page from the Comment Page. The Comment Page is accessed from the Main Page by clicking on the call sign of the desired flight. A user can enter three types of information:

1. Author - At least two characters must be entered in this field.

2. Priority – The default priority is "-". The user checks the 'High' check box in the Priority field to change the priority level.

3. Comment - This field is intended for any information about the flight of which the FAA should be aware. This provides a way for a NAS user to electronically communicate detailed information to the FAA.

After a comment has been added or revised, the Comment field on the Main Page displays "NEW" in red to indicate to the TCA that a new comment has been entered. After the TCA views the comment and clicks the TCA Acknowledge button, the red "NEW" in the Comment column on the Main Page is replaced by a black "Y" to indicate that the TCA has seen the comment entered by the user. A NAS user does not see the TCA Acknowledge button.

Add Flight Page. The Add Flight Page allows a user to add a flight to the DRWP Main Page. A manually added flight is removed either 2 hours after the ETD or whenever it is manually removed with the Delete Flight button on the bottom of the Comment Page. The data on this flight will not be automatically updated by ETMS. If the data on a manually added flight changes, then the user that added it should enter the updates.

Status Page. The Status Page allows the FAA to indicate whether DRWP is actively being used to monitor a diversion recovery event.

- Active means that a diversion recovery event is in progress and that the DRWP Main Page is being monitored by the TCA. This tells NAS users that the FAA will see and act on any information added to the Main Page.

- Inactive means that no diversion recovery event is in progress and that the DRWP Main Page is not being monitored by the TCA. This tells NAS users that the FAA probably will not see or act on any information added to the DRWP Main Page.

The first line of the Main Page shows whether the DRWP is active or inactive. The FAA, specifically the TCA at the ATCSCC, controls the DRWP status.

The Status Page is accessed by clicking on the Status Page button in the Control Panel. The Status Page button in the Control Panel is grayed out for NAS users, so only the TCA can access the Status Page.

Also, to make sure that the DRWP does not inadvertently stay active longer than it should, the TCA can specify how long the current DRWP event should remain active when the "Active" button is selected. When the specified time expires, the DRWP status is automatically changed from active to inactive.

Printer Friendly Page. Since the Main Page is not convenient for printing or for cutting and pasting, the Printer Friendly Page is provided for these purposes. The Printer Friendly Page reformats the information on the Main Page so that it can be printed and cut-and-pasted conveniently. While the Printer Friendly Page is displayed, it updates just as the Main Page. The Comment field can be removed from the Printer Friendly Page by clicking the Abbreviate button. An FAA user might find this useful since, if this field is removed, data from this page can be cut and pasted into ETMS e-mail without one line spilling over into the next.

Counts Page. The Counts Page provides a quick summary of the effect that the diversion recovery event is having on various airports by showing counts of diversion recovery flights for each origin airport, destination airport, and origin/destination pair. For example, if an airline sees that ten flights bound for Chicago have diverted to Milwaukee, the airline might decide to avoid the congestion at Milwaukee and divert to some other airport.

6.1.6.3 Interfaces

The DRWP receives flight data from ETMS. If 'DVRSN' is in field 11 of the flight plan, ETMS detects this and places the flight on this page with a priority of '-'. The data on the flight that is displayed on the page (including updates) is provided by ETMS. (Note: ETMS provides no data for flights manually entered by NAS users, and, a flight may appear twice on the DRWP if it is both detected by ETMS and entered manually by a user. It is generally the responsibility of the user to determine which entry to leave on the page, and to remove the other entry.)

6.1.6.4 Data Sources

The ETMS Flight Information database is the source of data for DRWP.

The Comment Page allows a NAS user to communicate special information about a flight to the FAA, and it also allows the TCA to acknowledge that this information has been seen. While it is expected that the NAS users will primarily be the ones to enter comments, there might be cases where an FAA user would enter a comment.

The Status Page information can be changed by the TCA. The radio button next to *Active* or *Inactive* is used to change the status of the DRWP. When the status is set to *Active*, the TCA can set / edit the time interval for which the DRWP remains active.

6.1.6.5 Outputs

The following data is shown on the Main Page for each diversion recovery flight:

- *ACID* - Call sign of the flight.
- *Type* - Display of this field is optional; Aircraft type, e.g., B757
- *Diverted To* - Departure airport of the diversion recovery flight. This is the airport to which the diversion leg is diverted.
- *ETD* - Estimate time of departure. This is the proposed wheels-up time at the departure airport. For flights that have DVRSN in field 11, the value in this field is set to the P-time plus 10 minutes. (The figure of 10 minutes is configurable and might be changed.) When an airline has multiple flights at the same airport, their priority for departure is determined by the ETD.
- *CTD* - Controlled time of departure. If this flight is in a ground delay program, this is the wheels up departure time that has been assigned to it. This is also called the EDCT.
- *DEST* - Arrival airport of the diversion recovery flight.
- *ETE* - Display of this field is optional. Estimated time in minutes that the flight is in the air.
- *DCENTR* - ARTCC that contains the departure airport.
- *ACENTR* - ARTCC that contains the arrival airport.
- *Priority* - Departure priority that an airline assigns to a flight relative to other flights of that airline at multiple airports.
- *Comment* - Shows if there is a written comment on this flight and if the Tactical Customer Advocate (TCA) at the Command Center has acknowledged it.

In addition to these fields, the Comment Page contains:

- *ETA* - Estimated time of arrival.
- *Source* - The reason(s) why a flight is on the DRWP.
- DVRSN: Field 11 of the flight plan contains (or at one time contained) 'DVRSN'.
- Manual: This flight was manually added by a user of the DRWP.
- *Last Comment Date* - The time and date when information on the Comment Page was last changed.
- *Comment Status* - Shows whether the TCA has acknowledged the last comment.

- *Author* - The name or initials of the last person to enter a comment.

The Counts Page shows three tables that summarize how the diversion recovery traffic is spread among the airports:

1. The first table shows how many diversion recovery flights there are for each origin airport. These flights are either on the ground at that diversion airport or in the air headed for it. These airports are the origins of diversion recovery flights. The origin airport is the airport shown in the 'Diverted To' column of the Main Page.
2. The second table shows how many diversion recovery flights there are for each destination airport.
3. The third table shows how many diversion recovery flights there are for each city pair.

6.1.6.6 Reference Sources

- *Briefing Document for the Diversion Recovery Web Page, Version 1.8, Report No. CDM-DRT-TRN-003*, dated 02/09/02; Volpe National Transportation Systems Center, U.S. Department of Transportation, Cambridge, MA
- *FAA Order 7210.3S Facility Operation and Administration; August 8, 2002*

6.1.6.7 Miscellaneous

Version No: Version 1.8

Development Languages: HTML, Perl script, CGI script, Java script

Platform: Windows 9X/NT/2000

COTS Products Used: None

Software Maintenance Organization: Volpe

6.1.7 Enhanced Status Information System (ESIS)

6.1.7.1 Overview

The Enhanced Status Information System (ESIS) is a projection system designed to provide a large, on the wall, display of currently required control-related information to controllers and TM specialists in each area of the control facilities in which is installed.

ESIS was developed at the Washington ARTCC (ZDC).

ESIS consists of two systems: the SIA and the TSD. Both are PCs, located at the area supervisor's desk. Video projectors mounted to the ceiling project status and TSD display information onto masonite screens placed at the end of each area.

The SIA uses the administrative PC in each supervisor workstation to support the preparation and display of status type information on ESIS. This type of information is completely flexible since all the ESIS SIA component currently does is enable the display of whatever information is selected for display. Information entered/displayed in this manner may be entered into a template designed for the area or facility. Currently, the most common use for this display capability is for relaying information about restrictions and runway closures, as well as the status of NAVAIDs and 'hot' military airspaces.

The other PC (TSD) allows the area supervisor to select a remote TSD to be displayed via ESIS.

ESIS has been in use in the ZDC control environment since April 2000, however, in the ZDC TMU, due to limited wall space, specialists use another information display tool (TMC Tools) which they describe as an 'ESIS-alternative'. TMC Tools is discussed under Section 6.3.9. ESIS was subsequently deployed across the NAS to, and is operational in, all 21 ARTCCs (including many TMU areas).

One ESIS unit consists of two Windows-based PCs (one administrative and one dedicated for TSD), two video projectors, two Masonite (each 3 ½' high by 8' wide) screens and includes a Uninterruptible Power Source (UPS) at each supervisor's desk to provide backup power to the equipment.

Bulbs for the projectors are costly however, and under the stress of 24/7 use burn out more quickly than originally anticipated. For that reason, though all ARTCCs have ESIS systems, not all ARTCCs are using them in every area at this time. Some have reverted to using paper to keep controllers and TM specialists informed. In some facilities, due to lack of wall space to locate an ESIS (ZDC is one), they are using other (often locally developed) PC based equivalents to provide timely status information to TM specialists. In most facilities, the primary use of ESIS (when it is functioning) seems to be for display of active military area status information.

The NTMLog Work Group is currently investigating the possibility of using ESIS with an Oracle output table setup to feed some TMLog information directly to ESIS displays, while also allowing supervisors to manually enter some additional locally useful information to complement TMLog data displayed.

6.1.7.2 Functions

Area Supervisors can enter data manually into a (locally developed) template or document at the SIA. The type of information often entered (SUA, restrictions and outages) was previously posted on status information boards or elsewhere in the air traffic control room, or distributed on paper to each sector. Large screen display of the SIA and the TSD provides critical information for review by control room team members.

Via the ESIS TSD interface, Area Supervisors can select the particular TSD/TSD view they wish to have displayed via ESIS.

6.1.7.3 Interfaces

ESIS relies on ETMS to be able to display the TSD, but there is no true interface between ESIS and ETMS. ESIS merely supports the redisplay of an already displayed TSD on a different display surface.

6.1.7.4 Data Sources

The SIA acquires its data via manual input from the Area Supervisor position administrative PC. A locally developed template may be used to enter data such as active SUA information, or other relevant control information as determined by local procedures.

The TSD interface allows the Supervisor to 'project' the current or remote TSD display as it is currently configured.

The TSD display relies on the ETMS network in order to be able to display ETMS data in graphical TSD form. The SIA PC is connected to the ADTN network and therefore supervisors may rely on data or application support programs (word processing software, spreadsheet software, etc.) stored/available on either the local PC or accessed via the ADTN (administrative LAN).

6.1.7.5 Outputs

The SIA or TSD information selected for display by the area supervisor is shown on the (usually) wall-mounted projection screen.

6.1.7.6 Reference Sources

- None

6.1.7.7 Miscellaneous

Version No: Information not readily available

Development Languages: Information not readily available

Platform: Windows PC; OS information not readily available

COTS Products Used: Information not readily available

Software Maintenance Organization: Information not readily available

6.1.8 e-Special Traffic Management Programs (e-STMP)

6.1.8.1 Overview

Special Traffic Management Programs (STMPs) are implemented for special events that attract thousands of people and aircraft to participating airports. To properly manage the flow of arrivals and departures for these events, the FAA requires users (i.e., non-scheduled IFR flight operators) to make arrival and departure reservations to and from these airports. The e-STMP web application allows users to request, confirm, update, and cancel a reservation online for a specific special event. It also lists the current special events and summary information about them. Special events are arranged in alphabetical order. The summary information includes the date(s) and time(s) of the event, airports where reservations are required, and any special routes that must be used.

The e-STMP application is available on both the Internet and the ATCSCC Intranet. Traffic managers access the Intranet link on behalf of users without Internet access.

See Section 5.3.3, Planning for Special Civilian Events, for more discussion of the use of the eSTMP tool.

6.1.8.2 Functions

Currently there are three applications supporting the STMP process: v-STMP for touch-tone phone reservations, e-STMP for making reservations over the Internet with a browser, and the ARO tool that allows command center specialists to make reservations.

- v-STMP is an application written in Visual Basic, and has touch-tone phone support by interacting via a third party product called PRONEXUS.
- e-STMP is an Internet Web Portal site that serves as the front end to making reservations. This web application allows users to register, reserve time slots, update and cancel time slot reservations.
- ARO Tool is a Visual Basic application that allows the ARO Position specialist to make, edit, cancel and force reservations.

Underlying these applications is an Oracle database that contains information about each registered e-STMP user and about each STMP event, including STMP event description fields and individual slot reservations. The STMP event description is created and maintained via a STMP database administration component. STMP reservations are created and maintained via e-STMP, v-STMP, and/or the ARO tool. The following subsections provide additional details for e-STMP and the STMP database administration components.

6.1.8.2.1 e-STMP User Reservation Component

Only registered users are permitted access to the e-STMP reservation system. Users register from the e-STMP Home Page, at which time they provide a username, password, and e-mail

address. The information is stored in the STMP Oracle database and is used to authenticate users on subsequent visits to the web site.

Making Reservations: In order to make a reservation, e-STMP requires the user to input the following:

- Type of request (arrival or departure reservation)
- Event name (select via displayed list)
- Airport (selected from list of airports associated with selected event)
- Desired date and time
- Tail number.

Optionally, the user can provide the aircraft type, the originating airport for an arrival reservation, or the destination airport for a departure reservation.

Only a limited number of arrival and departure reservations may be available at a STMP airport. If the requested arrival/departure time slot is unavailable, the system displays the nearest available times a reservation is available – one time before and one after the requested time. If a reservation is not required for the date and hour selected, the system informs the user that a reservation is not required. If the reservation is approved, e-STMP provides a reservation number to the user.

Confirming Reservations: Users are not required to confirm reservations. Once a reservation is made, it is final unless the user cancels the reservation. The confirmation option allows users to reconfirm reservations made either by the touch-tone phone system or the web interface.

Changing Reservations: The change/update option allows the user to modify an existing reservation. Only changes to the following can be made: the aircraft type, tail number, the originating airport for an arrival reservation, and the destination airport for a departure reservation. In order to update a reservation, the user must provide the reservation number and the event name.

Canceling Reservations: The cancel reservation option requires that the user supply the reservation number, event name, and aircraft id.

Reports: Currently a STMP summary report is generated dynamically when users access an access-controlled link on the ATCSCC Intranet. This report allows users to select an Event, Facility, Date, and Arrival/Departure/All. The report is sortable by all identified fields.

On-demand reports are available to airports or facilities participating on a STMP. Reports are available over the ATCSCC Intranet. Facilities are required to log on to the site using an assigned access code and password. The report contains: reservation number, airport, tail number, aircraft type, date and time, event name, airport, and originating airport for an arrival reservation / destination airport for a departure reservation.

6.1.8.2.2 e-STMP Database Administration Component

A STMP is defined using an event name, the date(s) and time(s) of the event, the participating airports, and restriction criteria for each airport. This information must be entered into the STMP database before reservations can be made. Currently, a programmer enters the STMP definition records into the Oracle STMP database by manually editing scripts and executing them. When a facility wishes to change the slot allocation for the STMP, a facility traffic manager contacts the Command Center or the authorized facility STMP administrator. The STMP administrator at the Command Center or facility makes the change using the STMP Remote Administration Application. This application allows authorized users to modify a STMP using a web browser that is connected to the ATCSCC Intranet web site. Users can view a STMP, modify STMP restrictions, add hours/days to a STMP, remove hours or days from a STMP, and/or cancel a STMP.

To ensure database integrity, only one user at a time can modify a STMP event. To prevent a user from opening an event for modification and then walking away without logging out, thus indefinitely blocking all other users from modifying the event, e-STMP has a session timer. At login the user is given 60 minutes to modify a STMP before the session expires and the user is automatically logged out. A clock in the upper left corner of the browser window shows the user the amount of time remaining in the current session.

During the STMP event, authorized users can place arrival and/or departure restrictions on specific hours or slots (i.e., 15-minute increments of time) by setting the restriction value for the hour/slot to one of the following three values.

1. No Reservation Required: there are no restrictions, anyone can fly-in
2. Reservation Required: sets a restriction based on a numeric limit
3. No Reservation Allowed: restricts the slot completely and the limit is set to 0

The table below summarizes elements related to adding or modifying STMP restrictions:

Item	Description
Time/Restrictions	UTC time of a STMP restriction for this facility/group/event
Arrival Limit	Maximum number of aircraft arrivals allowed for this facility/group/event in an hour or slot
Departure Limit	Maximum number of aircraft departures allowed for this facility/group/event in an hour or slot
Total Operations	Maximum number of arrivals and departures combined that will be allowed for this facility/group/event in an hour or slot.

Users generate reports manually. The reports may be directed to FAA facilities and other government organizations via e-mail. The following STMP reports are available:

- STMP Overview: General overview of STMP, dates, facilities, totals, grouping, and percentages.
- Total Transaction by Access Method: Totals for Web, Phone or ARO Tool access.

- Total Transaction by Airport: Report broken down with totals by airports.
- Transaction Type: Report that outlines how many reservations, edits of a reservation, and cancellations requests were made to the Oracle STMP database.
- Demand Capacity Arrivals: Outlines how many arrivals were made broken down by date and airport.
- Demand Capacity Departures: Outlines how many departures were made broken down by date and airport.

6.1.8.3 Interfaces

e-STMP does not interface with any other automated system.

6.1.8.4 Data Sources

All e-STMP data is manually entered.

Database programmers create STMP events in an Oracle database using automated scripts. STMP database administrators modify STMP event dates, times, and restrictions via a web-based user interface.

IFR flight operators enter and update STMP reservation requests via a web-based user interface.

6.1.8.5 Outputs

The e-STMP database administration components create and modify entries in the STMP Oracle database. User registration information for both the database administration components and the e-STMP user reservation component is also written to the database.

Authorized STMP administrators and e-STMP users view STMP information and reports via a web-based user interface. Status messages are also directed to the web-based user interface.

6.1.8.6 Reference Sources

- *e-STMP Phase III Development for the FAA (ATCSCC) Air Traffic Control System Command Center (Draft)*, February 2002; Kenrob and Associates
- *STMP Remote Administration Application*, October 2001; Kenrob and Associates
- *Special Traffic Management Program (e-STMP) Web Reservation Application*, August 2000; Kenrob and Associates

6.1.8.7 Miscellaneous

Version No: N/A

Development Languages: Java script

Platform: Windows 9x/NT/2000

COTS Products Used: Oracle

Software Maintenance Organization: Kenrob and Associates

6.1.9 Enhanced Traffic Management System (ETMS)

6.1.9.1 Overview

The Enhanced Traffic Management System (ETMS) is the heart of the TFM Infrastructure. ETMS is a mission-essential system used by TMSs and TMCs to track and predict traffic flows, analyze effects of ground delays or weather delays, evaluate alternative routing strategies, and plan flow patterns. ETMS predicts traffic demands over the next 15 hours. It displays data about the current and predicted state of the system and provides tools for computing and issuing traffic management initiatives.

ETMS was developed and deployed in the mid 1980s and has represented a quantum leap in the provision of decision support to traffic flow managers. ETMS consists of C and C++ application software operating on HP K and C boxes, and Linux workstations. ETMS is installed at the Hub facility at Volpe Center, the ATCSCC, all 21 ARTCCs, 37 TRACONs, 3 Combined Center Radar Approach control Centers, and 8 Air Traffic Control Towers. ETMS is also installed at 'international' sites in Canada, Mexico, Great Britain and Guam. Guam, technically a US military CERAP facility, and connected via Bandwidth Manager, is physically outside the NAS.

6.1.9.2 Functions

ETMS provides the TMCs with these major traffic management functions:

- Traffic Display - Current aircraft positions and weather are graphically displayed against a background of static data (e.g., boundaries, airports, NAVAIDs, and fixes) by means of the Traffic Situation Display (TSD).
- Congestion Prediction – ETMS' Monitor Alert function (MA) predicts the demand for airports, sectors, and fixes for 15 hours into the future and provides a graphical display of alerts, i.e. all airports, sectors, and fixes, for which the predicted demand exceeds the capacity.
- Congestion Management - ETMS provides tools that allow the TMCs to identify all flights that may intersect areas of severe weather or congestion in order select flights that are candidates for reroutes.
- Ground Delay Programs (GDP) - When excessive congestion is predicted, TMCs use ETMS functions to implement a ground delay program to establish appropriate delays for aircraft still on the ground whose destination is the congested airport.
- Reroute Programs - During severe weather, the TMCs use ETMS functions to implement rerouting decisions to determine the most efficient routes to detour aircraft around the weather.

To perform these functions, ETMS is divided into these processing areas:

- Geographical data processing - ETMS uses the geographical data to generate two products: the maps database (graphic files) and grid database (filed fight paths field 10 elements).
- Schedule data processing - ETMS uses the Schedule Data base (SDB) to provide schedule information in request reports to the traffic manager on a request/reply basis and to provide scheduled flight data for the Monitor Alert traffic demand predictions.
- Flight Database maintenance - ETMS maintains a live flight database for up to 12 hours in the past and 15 hours in the future.
- Field 10 Processing - Field 10 is the field of a NAS message that is used to specify an intended flight path using a sequence of fixes and routes.
- Flight Modeling - ETMS flight modeling uses the waypoint list produced by field 10 processing along with other extracted flight data to predict the impact of the flight on the airports, sectors, and fixes along its flight path.
- Traffic Demand and Alert Processing - ETMS uses the flight event data produced during flight modeling to estimate the demand at each monitored airport, sector, and fix, to generate an alert whenever a traffic demand is projected to exceed a pre-defined alert threshold.
- Traffic Management Data Processing - The FAA issues ground delay programs in order to prevent aircraft from arriving at an airport at a rate well above the rate the airport can accept.
- Displaying Data - ETMS displays data to the traffic manager through the TSD in four general forms: graphics drawn on a map, text reports, time lines, and bar charts.
- Aircraft Situation Display to industry - NAS data collected at the ETMS hubsite is made available to private industry by the Aircraft Situation Display (ASDI) feed.
- Flight Schedule Monitor - The Flight Schedule Monitor (FSM) is an ETMS application used by traffic managers to monitor and adjust airport capacity versus demand.

ETMS functions are categorized into three groups:

- ETMS Hubsite Functions - The processing and communications center of ETMS is the ETMS Hubsite, which receives a continual flow of data from numerous sources that provides information about flight operations. The ETMS hubsite functions are real-time, continuously running functions that are located at the Volpe Center and support the entire ETMS network. The ETMS Hubsite functions process the real-time incoming data, maintain a large distributed database, perform the traffic modeling, and transmit processed data to the field sites where traffic management is performed. The hubsite functions include: traffic management functions, traffic model functions, external communications function, schedule database functions, user interface functions, and ETMS communications functions.

- Field Site Functions - The ETMS Field-site functions, located at every field site where traffic management is performed, are run continuously. ETMS functions at the remote sites allow traffic managers to monitor traffic, model potential initiatives, and issue initiatives to the aviation community, including ATC facilities and airline operations centers. The ETMS field-site functions maintain local databases of data received from the ETMS Hubsite functions and make ETMS data available to the traffic manager through the TSD and other ETMS display functions. The ETMS field-site functions include the ETMS communications functions and the user interface functions.
- Ancillary Support Functions - The Ancillary Support functions are off-line functions that run periodically when data is received. The Ancillary Support Functions produce static databases and files for data such as the airline schedule data and geographical data. The ETMS hubsite functions and ETMS field-site functions use the static data during the real-time processing. The Ancillary Support functions run at the Volpe center only. The Ancillary support functions include these six functions: Process Geographical Data, Build Airline Schedule Database, Build Request Codes, Process Aircraft Type Data, Determine Departure Ground Times functions, and Dump Route DB.

Exhibit 6-45. ETMS Data Flow depicts the processing functions of ETMS.

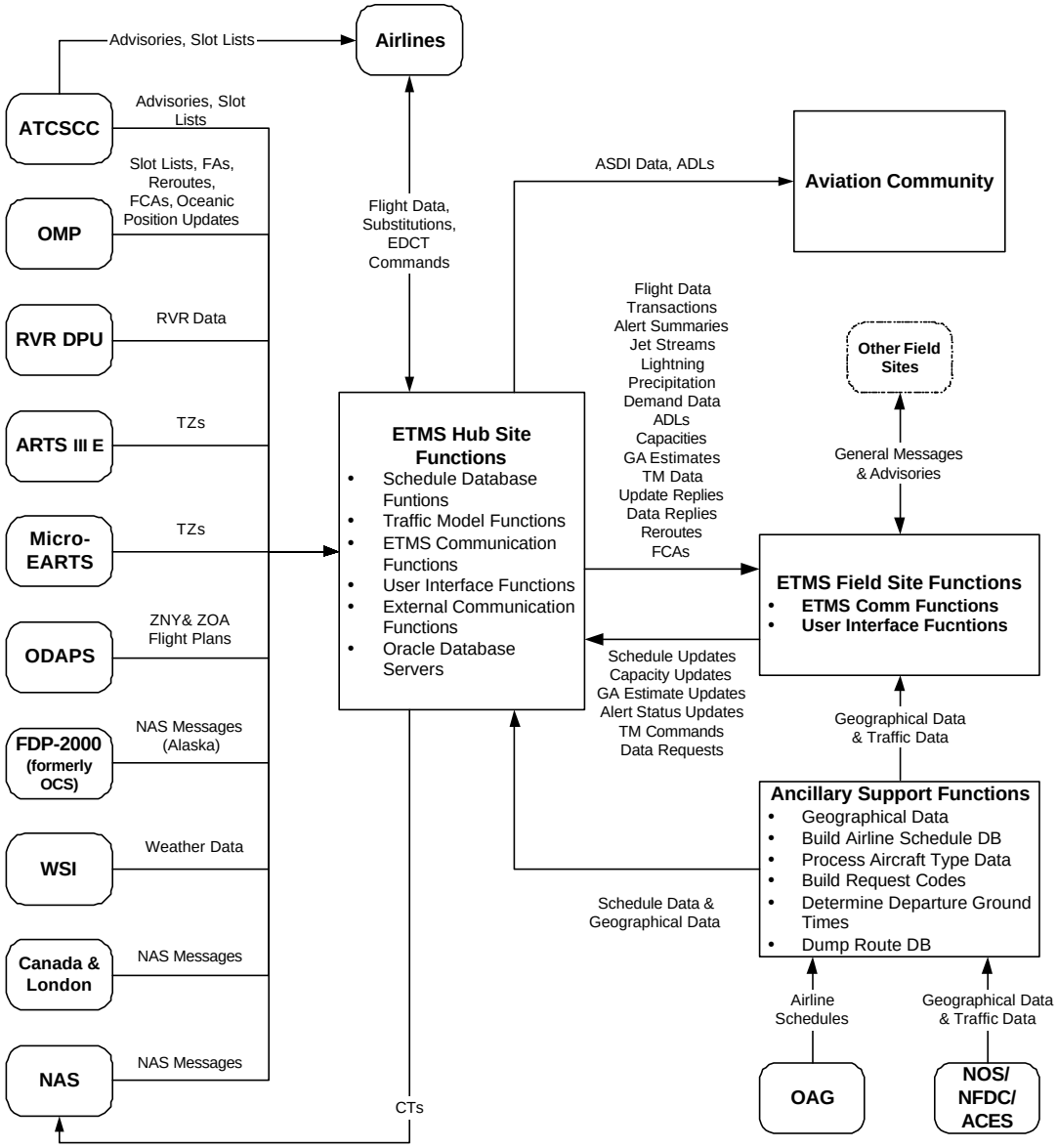


Exhibit 6-45. ETMS Data Flow

6.1.9.3 Interfaces

See Section 4, TFM Interfaces for ETMS External Interfaces discussion.

6.1.9.4 Data Sources

The primary inputs to ETMS are as follows:

- Airline schedules from the Official Airline Guide (OAG) - The airline schedule data files arrive weekly by communication link from the OAG, and is transferred

manually to the ETMS. The OAG file provides ETMS with the planned schedules of all flights arriving, departing, or over-flying the United States, Canada, or England. Each weekly OAG download provides schedules for the next 45 days.

- Flight data messages generated by airline flight data systems - The airline flight data messages provide ETMS with real-time schedule updates – cancels, delays, and new flight legs that occur during daily flight operations. Airlines generate VHF position update messages, which are received by ETMS over the ARINC network.
- Messages generated by various US ATC facilities (NAS messages) - The NAS messages provide ETMS with the flight plans and real-time event data (e.g., departures, arrivals, position updates) from various ATC systems. The main sources for US data are the ARTS at the TRACONs and the Host computers at the ARTCCs. The Host provides flight plan data as well as track updates for flights in en route airspace. This feed is supplanted by track updates from ARTS for flights in terminal areas.
- Flight plan and arrival messages from the ODAPS in the New York and Oakland Centers and from the OFDPS in the Honolulu CERAP. The Micro-EARTS in Alaska, San Juan, Honolulu, and Guam send position updates.
- Flight plan, departure, and arrival messages sent by the OCS (FDP-2000 interface) in Alaska
- Messages from International ATC Systems (Canadian, British, and Mexican ATC systems) and Guam - The Canadian system provides the full NAS message set from its operational centers: Gander, Moncton, Montreal, Toronto, Winnipeg, Edmonton, and Vancouver. The British, Guam and Mexican systems provide a partial data set, including flight plans, departure messages, and track updates.
- Weather data from the WSI - ETMS acquires weather data consisting of grid winds reports, current terminal surface observations (METAR/TAF), jet stream information, precipitation radar information, and lightning reports, via the WSI feed. The grid winds are used to compute flight times; the terminal weather reports, precipitation, jet streams, radar tops, and lightning are used for display purposes. The weather feed to ETMS includes also CCFP (NWF feed) and RVR data (NGRVR feed).
- Geographical data from ACES, NOS, and the NFDC - ETMS uses much of this geographical data to produce graphic displays (maps database) and for internal data processing (grid database). This includes boundaries, sectors, ARTCC boundaries, TRACONs, airways, fixes, NAVAIDs, airports, and SUA or Military areas. The data from ACES, NOS and NFDC is manually transferred to ETMS upon receipt.

6.1.9.5 Outputs

ETMS makes the following outputs available: geographical data, traffic situation data, Monitor Alert data, list report data, weather data, and traffic management data. The traffic manager accesses these types of data through integrated user interface functions, the primary of which is the TSD.

ETMS processes the air traffic data, along with weather and geographic data, to maintain a set of databases that represent current and projected traffic demand data over the next 15 hours. ETMS uses the airline schedules along with historical route data to add flights to the demand prediction 15 hours ahead of their scheduled departure times. ETMS uses the airline flight data messages to correct the baseline predictions from 15 hours ahead of departure right up to the activation of the flights. As flights near their departure times, new flight plans provide updated route information; ETMS uses the filed routes to further refine the demand predictions. Finally, as flights are activated, ETMS uses the real-time event data to update the current and projected data for airborne flights. The key part of the demand prediction is the Monitor Alert processing.

The local ETMS site performs such functions as: storing local traffic data, displaying data to users, and communicating with the ETMS Hubsite. Traffic managers at these sites use ETMS to model and distribute airport GDPs and GSs, define and distribute severe weather reroutes, and to send advisories to airlines via ARINC and to ATC facilities via NADIN.

The TMCs at the ATCSCC use the FSM in ETMS to issue GDPs and GSs. Ground stops are issued in a manner similar to the GDP. The slot assignments and control time generated for a ground stop are sent to the airlines to advise them of the ground stop. GDPs, reroutes, and other traffic management initiatives are transmitted to the air traffic community using the ETMS Email tool.

An additional output, consisting mainly of the raw NAS data, is provided to the aviation community through the ASDI data feed. This data is used in many different ways: for example, airlines may use this data in managing their operations, or airport operators may use it to post updated arrival times. The ASDI data is filtered before being sent out so that sensitive flights such as military flights, certain business flights, and sensitive remarks fields are not distributed. Also see the description of ASDI in Section 6.2.3.

Following subsections describe the major categories of ETMS output in more detail.

6.1.9.5.1 Geographical Data

The TSD uses geographical data to generate a set of graphic overlays that can be displayed on the TSD (maps database). The traffic manager can turn the overlays on and off by the use of menu selections and keyboard commands. The traffic manager can view map overlays with the traffic situation, weather, and Monitor Alert data. The TSD also uses geographical data to draw alert overlays on the display.

The following map overlays are available on the TSD:

- Boundaries - The boundaries represent the geographical boundaries for all countries. Within the United States, state boundaries are shown. Within Canada, province boundaries are also shown.
- Sectors - Sector boundaries can be displayed for low, high, super-high (ultrahigh), and oceanic sectors. If desired, the sector name may be shown in the middle of the sector.

- ARTCCs - ARTCC boundaries can be drawn for the 20 ARTCCs covering the CONUS, and the Alaska ARTCC. An ARTCC is shown as an outline with its optional name in the middle. Only the high-altitude ARTCC boundaries are displayed.
- TRACONS - Boundaries can be displayed for the TRACONS covering the CONUS. A TRACON is shown as an outline with the optional TRACON name in the middle.
- Airways – Jet and Victor airways can be displayed. Airways are shown as line segments with the optional airway numbers alongside. The colored airways (red, green, blue) are shown as Jet Routes. There is currently no classification of 'Oceanic Airways'.
- Fixes - Arrival, departure, and enroute fixes can be displayed. The fix name may be shown optionally adjacent to the fix icon.
- Navigational Aids (NAVAIDs) – Four types of NAVAIDS can be displayed (low, high, terminal, other). The user can select one or more to be shown, with or without their label. Latitude/longitude lines can also be displayed.
- Airports - Two sets of airports can be displayed: pacing airports and other airports. An airport is shown using a circle icon. The airport name may be shown optionally adjacent to the airport icon.
- Special Use Airspace or Military Area (SUA) - Five types of SUAs can be displayed: alert areas, Military Operation Areas (MOAs), prohibited areas, restricted areas, and warning areas. A SUA is shown as an outline and its optional name may be shown in the middle.

ETMS also uses the geographical data internally to perform the flight path processing and demand projections (grid database). Whereas the map overlays contain only the data desired for display, the grid database contains the most complete data available to support the *look-ups* that must be performed to interpret a flight plan. For example, the airports map overlay shows about 6000 airports; however, the internal airports database contains approximately 19,000 domestic landing strips that could conceivably be found in a filed flight plan. In other cases, data types that are used for the flight path processing are not available for display.

These are summarized as follows:

- Airspace fixes - In addition to the arrival and departure fixes previously described, ETMS keeps a file of all airspace fix names (five-letter) and locations.
- Departure Procedures (DPs) and Standard Terminal Arrival Routes (STARs) - ETMS maintains a file of all DPs and STARs. ETMS derives the maps database and grid database from data received every 56 days from the NFDC, NOS, and ACES, and from static data files provided electronically by the ARTCCs and by the ATCSCC.

6.1.9.5.2 Traffic Situation Data

The traffic situation data describes the state of the airborne flights at a given moment. The current use of the traffic situation data is for displaying the *live* flight positions. When displaying live data, the TSD indicates the position of each airborne flight by an airplane or triangular-shaped icon (indicating aircraft type class), a dot, a circle (indicating a flight that has landed), or an oval (indicating a flight in holding). The traffic manager can view data about each flight by requesting data blocks and/or flight paths. Data blocks show flight data in text form, including the flight ID, aircraft type, flight level, beacon codes, ground speed, estimated time to arrival, and optionally the origin/destination or filed flight path. Flight paths are drawn graphically, overlaid on the maps. ETMS updates live flight positions every minute.

ETMS obtains most of the flight information from the NAS messages, which consist of flight plans (FZs), flight plan amendments (AFs), departures (DZs), ARTCC boundary crossings (UZs), position updates (TZs), arrivals (AZs), and cancellations (RZs). ETMS also obtains oceanic position updates for oceanic flights from OMP. ETMS extracts values such as flight ID, aircraft type, and ground speed directly from fields of the NAS and OMP messages; the values displayed are the latest ones received for that flight.

ETMS computes displayed flight positions from TZ data for flights within radar coverage of the CONUS ARTCCs. For flights outside of ARTCC coverage, ETMS computes displayed flight positions from the OMP messages. ETMS also computes displayed flight positions for flights outside of ARTCC and OMP coverage.

ETMS draws the flight path by interpreting the flight plan Field 10 (filed flight path text). ETMS uses a geographical database and built-in knowledge of the Field 10 syntax to determine the waypoints of a route. The waypoints are then used to generate the flight path display. ETMS also determines the origin and destination points as well as the airways, sectors, fixes, and ARTCCs that each flight is traversing.

The traffic manager can instruct the TSD to display or highlight only flights with certain characteristics such as flight IDs, aircraft types, and flight levels. The traffic manager can use the TSD to perform historical functions (with traffic situation data by using the History or Replay feature) and predictive function (using the FEA/FCA features).

Also see the description of Traffic Situation Display in Section 6.1.23.

6.1.9.5.3 Monitor Alert Data

Monitor Alert data allows TMCs to examine the current or projected traffic demand values at airports, sectors, and fixes, and to be automatically alerted if the projected demands exceed the alert threshold. The demand counts for each element type are defined as follows:

- Airport – the numbers of arrivals and departures per 15-minute interval
- Sector – the number of aircraft in the sector at the peak minute during each 15-minute interval
- Fix – the number of flights crossing the fix in each 15-minute interval.

- Alert thresholds are specified in the same units as the demands.

ETMS computes traffic demands from the OAG schedule data, the airline flight data messages, and NAS messages, and controls issued as part of a GDP or ground stop. ETMS initially loads scheduled flights into the traffic demand database when the scheduled departure times are within 15 hours of the current time. ETMS applies historical routes to the OAG flights to project the initial impact of these flights on the airspace. ETMS updates the traffic demands continuously with the airline flight data messages and NAS data as it becomes available.

Airline flight data messages provide updates on what flights are operating, via flight create (FC) and flight cancel (FX) messages, and changes to the planned operation of a flight such as delays or destination changes, via flight modify (FM) messages.

NAS flight plans provide additional information on what flights are expected to operate, and most importantly, the planned routes, cruising speed, and cruising altitude. Other NAS messages, such as departure messages and track updates, are used to continually refine the demand predictions.

The TSD displays alerts graphically on the screen. The TSD draws alerted elements (sectors, fixes, and airports) in red if the alert is caused by active flights only, and in yellow if the alert is caused by a combination of active and proposed flights. The TSD symbolizes airport alerts by circles at the airport locations, fix alerts by triangles at the fix locations, and sector alerts by the sector boundaries filled with patterns indicating the sector type. The altitude level(s) at which a fix is alerted is indicated by a short line(s) extending to the left from the triangle. A line at the bottom of the triangle indicates that the low level fix is alerted. A line from the middle of the triangle indicates that the high level fix is alerted. A line from the top of the triangle indicates that the super-high level fix is alerted. The traffic manager can select the types of elements (e.g., high sectors, airports, etc.) for which alerts should be displayed. The traffic manager also can enter a time period defining the *look-ahead* time for which the manager would like to receive alerts (e.g., show alerts for the next hour).

The traffic manager can view traffic demands for alerted and other elements on the TSD through charts, reports, and flight displays. Charts are bar graphs of demand counts vs. the alert thresholds for a specified time range. Airport charts show arrival and departure values on separate charts. Reports are textual listings of the flights that comprise the demand for each 15-minute interval along with the relevant event times. Airport reports show arrival and departure times, sector reports show the entry and exit times, and fix reports show the fix crossing times. The flight display shows the positions and flight paths of the aircraft for a specified time interval.

Traffic managers can also view Monitor Alert threshold values using the Capacity List (CAPL) report, and can modify these values using the *Capacity Set (CAPS)* function.

After an alerted element is examined, the traffic manager can change one or more 15-minute intervals of the time bar to green. This indicates that the manager is resolving the alert for that time period. Managers at the ATCSCC are authorized to turn an interval green for any element. Managers at TMUs are authorized to turn an interval green only for elements within their

region. During the next Monitor Alert update, those intervals that have been turned green are displayed as such on all TSDs at all sites.

Also see the description of Monitor Alert in Section 6.1.15.

6.1.9.5.4 List Report Data

List reports are textual reports of flights arriving at, departing from, or traversing an airport, fix, sector, or ARTCC. Some reports provide data records for each individual flight, while others show only the number of flights in each time interval. A traffic manager can request reports through the TSD or the TM Shell. Report data is available for times up to 12 hours in the past for any location, and up to 28 days in the future for airports and ARTCCs, or up to 15 hours in the future for sectors and fixes.

ETMS allows the traffic manager to request nine types of reports:

1. Sector Counts (AREA) - Lists flights traversing a specified sector or multiple sectors.
2. Arrival Delay Prediction (ARRD) - Predicts arrival delays for specified airports.
3. Flight Counts (COUNTS) - Lists flight counts for an airport, fix, sector, or ARTCC.
4. FCA Reports (FCATA) - Generates FCA reports using COUNT, and LIST.
5. Fix Loading (FIXL) - Lists flight counts for an arrival fix or for all arrival fixes for an airport.
6. List Flight Plan (LIFP) - Lists flight plans for specified flights.
7. Flight List (LIST) - Lists flight information for an airport, fix, sector, or ARTCC.
8. Flight List Original (LISTO) – Same as LIST except that original times are displayed instead of controlled times for controlled flights that have not departed.
9. Verify Time (VT) - Compares actual arrival/departure times with a specified time type.

6.1.9.5.5 Weather Data

Weather Services International (WSI) is the primary source of weather data for ETMS. ETMS stores weather updates from WSI and makes them available for display in a variety of ways, mostly through the TSD. ETMS also receives the Collaborative Convective Forecast Product (CCFP) from the Aviation Weather Center (AWN) via the National Weather Service (NWF) feed. The CCFP is available for display on the TSD, WSD, and CCSD.

ETMS provides routine hourly weather reports (METARs) and forecasts (TAF) to the traffic manager. The manager can request these reports for any airport through the TSD. Scheduled METAR updates arrive hourly and include the current cloud cover, precipitation, ceiling, visibility, wind speed and direction, temperature, dew point, and barometric pressure.

Scheduled TAF updates arrive every 9 hours and include a detailed forecast for the next 18 hours plus a general forecast for an additional 6 hours. In addition, ETMS checks for any METAR/TAF amendments or updates every 10 minutes.

ETMS also processes grid winds reports, which provide wind estimates for the airspace over the northern hemisphere. The grid winds report provides wind estimates for 15 different altitude ranges. Grid winds are received every 3 hours and project the winds for the next 12 hours. ETMS uses the grid winds data to estimate the effect of high-level winds for each segment of a flight path.

The TSD provides the manager with a Jet Stream overlay, which shows the perimeters of the jet-stream winds and gives the direction, speed, and flight level (altitude in 100-foot levels) of the winds. ETMS receives this information from WSI every 3 hours.

The TSD provides overlays that show precipitation information over CONUS, Southern Canada, and Puerto Rico. These overlays, which can be displayed together or separately, may be provided to the TSD at resolutions of NOWRAD (2 km or 8 km). Normally only the NOWRAD 2km data is distributed to field sites; however, the NOWRAD 8km data is provided if the 2km data becomes unavailable. The TSD displays this data as a six-level color-coded overlay where each block is color-coded to represent the most severe precipitation occurrences within the block.

The CONUS overlay is updated every five minutes. The Southern Canada and Puerto Rico overlays are updated every 15 minutes.

ETMS continuously receives and accumulates lightning strike data into files that are provided to the TSD at 5-minute intervals.

The TSD provides an overlay that shows the Collaborative Convective Forecast Product (CCFP). Specialists can select which forecast product is to be displayed by selecting from the 2-hour, 4-hour, or 6-hour forecast products. ETMS receives these forecast products, now year round, every 2 hours from 1100Z to 2300Z.

The TSD also provides a Radar Tops overlay, which shows the altitude of cloud tops within precipitation areas. The labels indicate the altitude of cloud tops in hundreds of feet. ETMS receives this information every ten minutes.

ETMS provides Runway Visual Range (RVR) reports to the traffic manager. Specialists can request these reports for any airport through the TSD. RVR data is received on a continuous basis every two seconds from the airports that are equipped to provide the data to ETMS.

6.1.9.5.6 Traffic Management Data

ETMS provides access to four categories of traffic management data: GDP and ground stop data; reroute data; flow evaluation and flow constrained areas; and advisories.

GDP data is available in a number of ways. Using EDCT commands through the TSD, TM Shell, or FSM, a traffic manager can see:

- A list of current GDPs and ground stops in the system; airlines can also see this data
- The substitution status of the GDPs; airlines can also see this data
- Flight details for any given airport; airlines can see this for their own flights
- The history of actions that have been taken by the FAA and the airlines
- Details for a specific flight

When a ground stop is issued using FSM (see Section 6.1.9.5.7), the same data is available; however, ground stops are not always issued this way. By using the FSM, a traffic manager or airline can see the parameters used to compute the GDP or ground stop.

The traffic manager can use the TSD to perform predictive functions using the FEA and FCA features. The FEA/FCA is a defined volume of airspace. The traffic manager can define a volume of airspace by drawing a polygon on the TSD display and then, using a dialog box, the manager can define the altitude range of the FEA/FCA. Alternatively, the manager can designate a NAS element as an FEA/FCA. The manager also defines the time period of the FEA/FCA that ranges from the current time to 15 hours in the future. The manager can define the filter criteria for filtering the list of flights that are predicted to intersect the FEA/FCA. Using the FEA/FCA functions, the manager can obtain reports of the FEA/FCA flights for a specified time period. The manager can view the current position of those flights on the TSD display.

Traffic managers at ETMS field sites can create FEAs to be used to evaluate the flow of traffic in the defined volume of airspace. An FEA can be shared with traffic managers within the user's facility and with traffic managers at other designated ETMS facilities. Specialists at the ATCSCC can create FCAs that will be made public to be shared with all ETMS users and with the airlines. Also see the description of FEAs/FCAs in Section 6.2.4.

During severe weather season, the ATCSCC uses the TSD to analyze and distribute severe weather reroutes. When a reroute is being considered for a particular segment of traffic, traffic managers use the *Flow Evaluation and Flow Constrained Areas* and *Select Flight* capabilities of the TSD and the ETMS *List Request* functions to analyze the traffic that would be affected by a proposed reroute. Using the TSD, traffic managers can devise a rerouting plan from a set of predefined plans called the Playbook. Traffic managers can tailor these Playbook reroute plans or they may define ad hoc rerouting plans. When a rerouting plan is actually issued, ETMS assists in two ways. First, TSD formats the textual description of the current reroutes into an advisory, which can then be transmitted to the ATC community. Secondly, ETMS distributes the information necessary to draw the reroutes to all TMUs so that traffic managers at any ETMS site can view the reroutes graphically on their TSDs. The airlines can view the reroutes using the CCSD.

Advisories regarding GDPs, reroutes, and other traffic management actions are sent using the ETMS Email function. Messages are sent to the ETMS Hubsite, and then re-distributed to the addresses. Depending on the addressee, the advisory may go out over the ETMS communications network, the NADIN network, or the ARINC network.

6.1.9.5.7 Flight Schedule Monitor Data

The airport GDP process requires significant interaction between the FAA and airspace users, mainly airlines. The GDP is a collaborative process where first the FAA issues the need for a GDP as an advisory. The airlines can model the anticipated GDP to determine the impact on their operations, and may choose to modify their schedules to reduce the need for a GDP. If a GDP is still needed, the FAA computes and issues slot assignments and control times. Airlines continue to adjust controls and schedules to reflect their operations. Finally, the FAA monitors the performance of the GDP and compresses or revises it as indicated by the demand.

The primary tool used by both the FAA and airlines during a GDP is the *Flight Schedule Monitor* (FSM). FSM allows a user to monitor demands, view the projected airport arrival rate (AAR) and GDP parameters, compute slot assignments, and generate the data necessary to issue the GDP. Other ETMS tools used during a GDP are *Autosend*, which is used to send the slot assignments to the ETMS Hubsite, TMUs, and airlines. *Email* is used to issue the advisories.

The FSM provides a graphical flight list display that shows flight icons placed along hourly time lines at their predicted arrival and/or departure times.

An important part of the GDP data distribution is the generation of the CT message. A CT is a message issued from ETMS to the Host computers notifying Host that a flight has an EDCT. Host responds to the CT message by printing the EDCT time on the flight strip, thus notifying the departure controller that the flight is delayed.

Ground stops can also be issued in a manner similar to the GDP. The slot assignments and control time generated for a ground stop are sent to the airlines to advise them of the ground stop; however, the EDCTs are not sent to the TMUs and do not cause CT messages to be sent to Host.

GDPs, reroutes, and other traffic management initiatives are transmitted to the air traffic community using the ETMS Email tool. Email messages are sent to the ETMS Hubsite where they are routed to the appropriate network.

Also see the description of the FSM tool in Section 6.1.14.

6.1.9.6 Reference Sources

- Enhanced Traffic Management System (ETMS) Functional Description, Version 7.4, Report No. VNTSC-DTS56-TMS-002, dated June, 2002 (Draft); Volpe National Transportation Systems Center, U.S. Department of Transportation, Cambridge, MA

6.1.9.7 Miscellaneous

Version No: Version 7.5

Development Languages: C, C++

Platform: HP 9000/C 360, UNIX servers

COTS Products Used: Oracle SQL, HP-UX 11.0, Linux Redhat 7.3, I/O Concepts 5.51, I/O Concepts 9.1.8

Software Maintenance Organization: Exhibit 6-46. EMTS Software Maintenance Table lists the responsible organizations that are maintaining the various software components of ETMS:

Exhibit 6-46. EMTS Software Maintenance Table

ETMS Functions	Components	Organization
Schedule Database Functions	SDB Server	Volpe
	SDB List Server	Volpe
	Update/Request Server	Volpe
Traffic Model Functions	Flight Database Processor	Volpe
	Traffic Demands Database Processor	Volpe
	FCA Traffic Analyzer (FCATA)	Volpe
	Parser	Volpe
	Route Database	Kenrob and Associates
	Store Flushed Flights (SFF)	Volpe
	ASDI	Volpe
Traffic Management Functions	EDCT Request Server	Volpe
	EDCT Manager	Volpe
	ADL Data Distributor	Volpe
ETMS Communications Functions	Local Site Switch	Volpe
	Local Node Switch	Volpe
	RTR (router)	CSC
	Communications Gateway	Volpe
	File Transfer (FTP)	Volpe
	Remote Command Execution (CMD)	Volpe
	Flight Database Distribution (FDBD)	Volpe
	FDB Router (FDBR)	Volpe
External Communications Functions	NAS Data Acquisition	Volpe
	NAS Distribution (NDIST)	Volpe
	Parser	Volpe
	Autosend	CSC
	IFCNE	Volpe
	CTFWRD	Volpe
	ARINC Interface (ARINC)	Volpe
	Flight Data – Front End (FD_FE)	Volpe
	OMP Parser (OMP)	Volpe
	Weather Transmitter	Volpe

ETMS Functions	Components	Organization
	Weather Server	Volpe
	OAG Interface	Volpe
	ADL Front End (ADL_FE)	Volpe
	EDCT Manager (EDCT)	Volpe
	RVR TRACON Server	Volpe
	RVR Collector	Volpe
	RVR Network Addressing Proxy Server	Volpe
User Interface Functions	Flight Table Manager	CSC
	Alert Server Processor (ASP)	Volpe
	Reroute and FCA Database Functions	Volpe
	Reroute and FCA Database Server (RRSVR)	Volpe
	Reroute Database Hubsite Server (RRHUB)	Volpe
	Routing Database Proxy Server (RDPS)	Volpe
	List Server (LSNET)	CSC
	FTM Coprocessor (FTM Coproc)	CSC
	TSD	Volpe
	Data and Communications Server (DACS)	Volpe
	TMShell	Kenrob and Associates
	Delay Manager	CSC
	Electronic Mail (Email)	CSC
	ALMON (Alert Monitor)	Volpe
Ancillary Support Functions	Process Geographical Data	Volpe
	Build Airline Schedule Data	Volpe
	Process Aircraft Type Data	Volpe
	Build Request Codes	Volpe
	Determine Departure Ground Times	Volpe
	Dump Route DB	Kenrob and Associates
Database Servers	Oracle Database Server	Kenrob and Associates
	Playbook	Kenrob and Associates
	RMT Database	Metron Aviation
	Public Reroutes	Kenrob and Associates

6.1.10 ETMS Autosend

6.1.10.1 Overview

Traffic Management Specialists at the ATCSCC use ETMS Autosend to automatically construct the advisories and data files needed to implement a ground delay program, using Fuel Advisory Delay Table (FADT) reports. Constructed data files include delay times as well as advisories to be sent through the NADIN, ARINC Network or to other ETMS workstations. Once advisories have been created, they can be sent by Traffic Management Specialists at the ATCSCC through ETMS EMail. The capability to send advisories is limited to the ATCSCC, and Canadian sites (in actuality, only Toronto uses this function). In addition, the EOF would have this capability if operating as the ATCSCC backup facility. The ETMS field sites use Autosend for creating subfiles as well as for viewing and evaluating Selected Control Departure Times (SCDTs).

ETMS Autosend (ATS) can be invoked from the toolbar. ATS can also be run from the Unix command line interface using Quick Autosend. Some ETMS processes use the Quick Autosend function to interface with the ATS process.

6.1.10.2 Functions

All of the functions listed below may be performed using ETMS Autosend:

- Search for a Fuel Advisory Delay Table (FADT) report
- Edit Fuel Advisory (FA) Table
- View and evaluate SCDTs
- Create subfiles containing Estimated Departure Control Time (EDCTs) and Fuel Advisories (FAs)
- Send EDCTs and FAs

6.1.10.3 Interfaces

The ATS process is designed to send messages to the Router (RTR) process using a particular network addressing scheme. The ATS process sends selected delay information to ETMS, ARINC, and NADIN.

The ATS process sends Ground Stops and Ground Delays to the National Traffic Management Log Program (TM Log).

The ATS GUI allows the user to select Fuel Advisory Departure Trail (FADT) reports, reduce these reports into distinct sub-files, and send particular delay information.

6.1.10.4 Data Sources

The primary data sources to Autosend include FADT Reports, SCDT Reports, airline addresses, and center addresses. Other inputs include selections made through the ETMS Autosend user interface to perform the Autosend functions listed in Subsection 6.1.10.2.

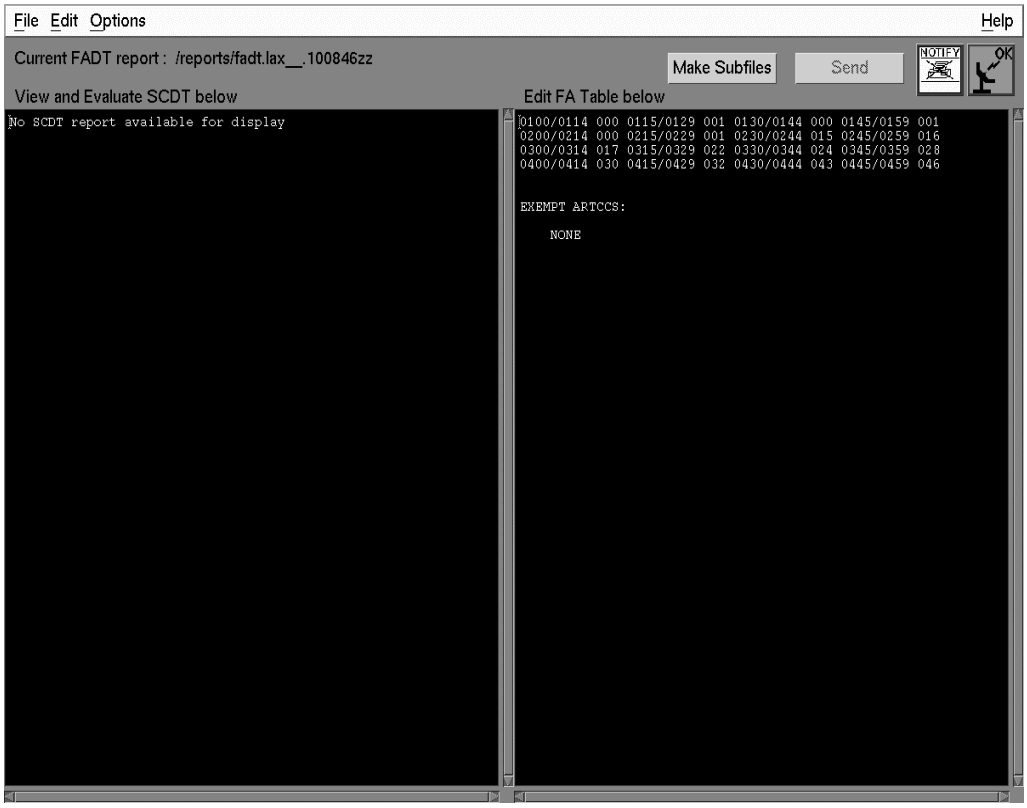


Exhibit 6-47. ETMS Autosend User Interface

6.1.10.5 Outputs

The main outputs from Autosend are EDCTs and FAs that are sent to the external communications processes for further distribution.

The display outputs available through the ATS user interface include the following:

- Statistics (s0 level) report, used for performing system administrative diagnostics
- FADT Report display
- Checklist of each airline and ARTCC listed in the report, and a checklist of all ETMS Hub locations
- Subfiles containing EDCTs and FAs

A communication connection status icon continually displays the status of the connection between Autosend and ETMS Communications. Also, if the user clicks on the "Notify" icon, an Autosend Notify window displays on the screen.

6.1.10.6 Reference Sources

- *Enhanced Traffic Management System (ETMS) Functional Description, Version 7.4, Report No. VNTSC-DTS56-TMS-002*, dated June, 2002 (Draft); Volpe National Transportation Systems Center, U.S. Department of Transportation, Cambridge, MA
- *Enhanced Traffic Management System (ETMS) Reference Manual, Version 7.4*, Report No. VNTSC-DTS56-TMS-004, dated May 2002; Volpe National Transportation Systems Center, U.S. Department of Transportation, Cambridge, MA
- *Draft ETMS System Design Document, Version 6.0*, Report No. Volpe Center-DTS56-TMS-008, dated March 1999; Volpe National Transportation Systems Center, U.S. Department of Transportation, Cambridge, MA

6.1.10.7 Miscellaneous

Version No: ETMS 7.5

Development Languages: C

Platform: HP-UX 11.0, Red Hat Linux 7.3

COTS Products Used: None

Software Maintenance Organization: Computer Sciences Corporation (CSC)

6.1.11 ETMS Electronic Mail (ETMS Email)

6.1.11.1 Overview

ETMS E-Mail allows users to construct and send numbered advisories or general messages to NADIN, ARINC, or ETMS addresses. E-Mail messages can be constructed from reports or from standard, sent, received, or saved messages. Messages can also be built by entering free format text. The message can be addressed to any or all of the three destination types (NADIN and ARINC addresses are limited to the ATCSCC) by selecting one or more addresses from each destination address menu, selecting address group names from the address group menu, and by editing the address input area.

Advisories may only be sent from the ATCSCC. General messages, however, may be sent from the ETMS field sites. ETMS Email Notify function is installed at all facilities with ETMS.

ETMS E-Mail can be invoked from the toolbar, using the ETMS menu to select the Email icon. ETMS E-Mail may also be started through the Unix command line interface, using Quick E-Mail. Other ETMS processes use the Quick E-Mail function to interface with the ETMS E-Mail process.

ETMS Email has been modified to add an Emergency popup message as well to support the ERIDS Emergency messaging capability still under development. That capability will send a one-way Emergency to the ATCSCC from any facility where ERIDS is installed (currently only ZBW, ZJX and ZLC), advising ATCSCC traffic managers that a HIJACK, BOMB or other emergency of national significance was occurring.

6.1.11.2 Functions

The functions listed below may be performed using ETMS E-Mail:

- View or Change E-Mail Setup
- Select a Message Type (ATCSCC only)
- Compose Message
- Save Message
- Specify Addresses
- Print and Send Messages

6.1.11.3 Interfaces

The E-Mail process is designed to send messages to the Router (RTR) process using a particular addressing scheme. The RTR is a function that connects to a node switch. The RTR allows the manager to send and receive messages at the *ETMS User Functions.* It is responsible for the notification of all messages sent from the E-Mail function destined for another RTR, messages received from another RTR, and any error messages encountered. The RTR must be connected

to a node switch to allow RTR to communicate with E-Mail for message transmission through the ETMS communications software.

The E-Mail process interfaces with the National Traffic Management Log Program (TM Log) by sending advisories from E-Mail to TM Log.

6.1.11.4 Data Sources

Data sources include the following:

- Selections made through the ETMS E-Mail user interface
- ETMS, NADIN, and ARINC addresses
- Address groups
- Reports, standard, sent, received, or saved messages.

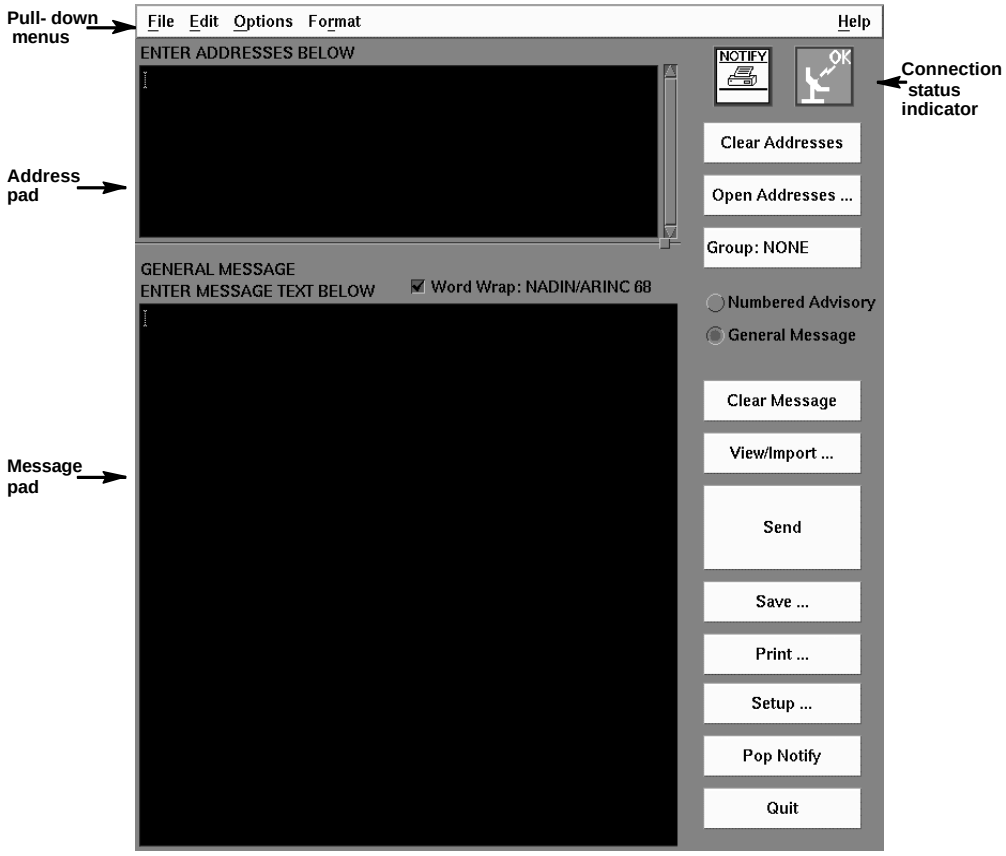


Exhibit 6-48. ETMS Email User Interface

6.1.11.5 Outputs

The main outputs from E-Mail are general and advisory messages that are sent to the Router and communications processes. The display outputs available through the E-Mail user interface consist of the ETMS E-Mail GUI, including E-Mail messages, addresses, and address groups. There is a statistics (s0 level) report available, for performing system administrative diagnostics.

6.1.11.6 Reference Sources

- *Enhanced Traffic Management System (ETMS) Functional Description, Version 7.4, Report No. VNTSC-DTS56-TMS-002*, dated June, 2002 (Draft); prepared by Volpe National Transportation Systems Center, U.S. Department of Transportation, Cambridge, MA
- *Enhanced Traffic Management System (ETMS) Reference Manual, Version 7.4*, Report No. VNTSC-DTS56-TMS-004, dated May 2002; Volpe National Transportation Systems Center, U.S. Department of Transportation, Cambridge, MA
- *Draft ETMS System Design Document, Version 6.0*, Report No. Volpe Center-DTS56-TMS-008, dated March 1999; Volpe National Transportation Systems Center, U.S. Department of Transportation, Cambridge, MA

6.1.11.7 Miscellaneous

Version No: ETMS 7.5

Development Languages: C

Platform: HP-UX 11.0, Red Hat Linux 7.3

COTS Products Used: None

Software Maintenance Organization: Computer Sciences Corporation (CSC)

6.1.12 ETMS Log (LOG)

6.1.12.1 Overview

The ETMS Log program is an ETMS application used by the traffic management specialist to record operational air traffic control activities and other types of data, using standard forms and templates. The Log program can then be used to modify, save, or print these forms.

The ETMS Log program is currently being used at many field sites including the ATCSCC. The logs created in ETMS Log at the Command Center are sent to the ATCSCC Intranet web server every 5 minutes, so that ATCSCC logs can be viewed by other facilities. ATCSCC specialists cannot however see (ETMS) logs created at other facilities.

This application is in the process of being replaced by the TM Log (National Log) application.

6.1.12.2 Functions

The ETMS Log application can be invoked from the toolbar to allow traffic management specialists to create new logs, modify existing log entries, add new entries to a log, and print logs at a default printer.

6.1.12.3 Interfaces

The ETMS Log program provides a GUI display consisting of the following:

- Log name
- File, Edit, Options, Logs, and Help drop-down menus
- New, Edit/Save, Print, and Exit buttons
- Log section containing all entries for current log
- Active mode or diagnostic messages.

6.1.12.4 Data Sources

Data inputs to the ETMS Log application include existing ETMS Log files invoked for updating as well as inputs entered by the traffic management specialists.

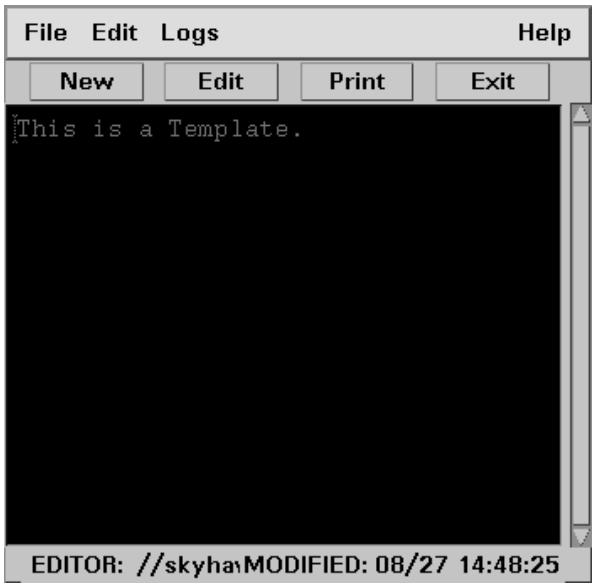


Exhibit 6-49. ETMS Log in Viewing Mode

6.1.12.5 Outputs

The ETMS Log outputs include the GUI display as outlined above in Section 6.1.12.3, and printouts of the logs. ETMS log data from ATCSCC specialist positions are sent every 5 minutes to the ATCSCC Intranet webserver for viewing by other specialists across the NAS.

6.1.12.6 Reference Sources

- Enhanced Traffic Management System (ETMS) Functional Description, Version 7.4, Report No. VNTSC-DTS56-TMS-002, June 2002
- Enhanced Traffic Management System (ETMS) Reference Manual, Version 7.4, Report No. VNTSC-DTS56-TMS-004, May 2002

6.1.12.7 Miscellaneous

Version No: ETMS 7.5

Development Languages: C

Platform: HP-UX 11.0, Red Hat Linux 7.3

COTS Products Used: None

Software Maintenance Organization: Kenrob and Associates

6.1.13 Flight Schedule Analyzer (FSA)

6.1.13.1 Overview

Flight Schedule Analyzer (FSA) is an analysis tool developed to explore the effectiveness of Ground Delay Programs (GDPs). FSA provides information allowing ATCSCC specialists to:

- Monitor compliance to control times
- Detect system 'gaming' (additional flights added just to ensure slots are kept)
- Identify data processing errors and other data quality problems
- Identify operational practices that lead to under or over delivery of TM initiatives
- Identify issues with current slot assignment procedures

The data used in FSA can be filtered and grouped in a variety of ways and a number of reports and types of analysis are available.

FSA allows the traffic flow management specialists at the ATCSCC to evaluate the effectiveness of GDPs and to identify problems in real time so that they can take corrective actions while the GDP is executing. FSA provides greater awareness of the factors that are impacting GDP performance and why they are happening. The drill-down capability of FSA allows users to see all the Aggregate Demand List records received for a specific flight. This capability makes troubleshooting of data problems easier.

A Real Time (RT) FSA version has now been implemented on the ATCSCC Intranet to allow airlines to use FSA capabilities to monitor their own compliance, identify data problems, and analyze programs prior to implementation to see what can be done to mitigate the need for these programs from the airline end. See also Section 6.2.5.2.11 on RT FSA via the OIS web page. Volpe operational staff and the ATCSCC CSA monitor compliance using RT FSA. The Quality Assurance staff at ATCSCC uses the FSA web interface to review and reconstruct each day's GDP. See Section 5.3.4, Analyze TM Initiative Effectiveness, for screen captures and further information on how the RT FSA tool is used.

FSA was deployed at the ATCSCC in April 2000 to address the compliance report issue. Prototype Post Analysis FSA and Real Time FSA have been evaluated by the ATCSCC since Fall 2000, and the Quality Assurance Department has been using FSA to review GDP performance, data problems, and irregular operations. Real-time FSA was deployed in April 2001 and became available on the ATCSCC Intranet for airline users during the summer of 2002.

6.1.13.2 Functions

FSA functionality is divided into two components:

1. Post Analysis FSA - Post analysis FSA is a client-server application that graphically shows data and analysis results on how well a GDP performed and

what factors impacted performance. The data used in FSA can be filtered and grouped in a variety of ways to suit user needs.

2. Real-time FSA - Real-time FSA is a web-based application that generates a collection of dynamic web-based reports that allows the ATCSCC to monitor GDPs as they are executing. Reports generated are: (1) Performance; (2) Flight status; (3) Compliance; (4) Cancelled flights that operated; (5) Pop-up flights; (6) Time-out delayed flights; and (7) GDP Program events. These reports are dynamically updated every five minutes as new flight information is received. Drill-down features allow the user to interactively query the database for additional flight information. Real time FSA is accessed from the ATCSCC Intranet web site.

FSA measures GDP performance by the following criteria:

- Aircraft landed versus airport AAR/program rate
- Rate Control Index
- Delay (ATC, Absolute)
- Airborne Holding.

The factors that impact performance are:

- Compliance to Control Times
- Data quality (pop-ups, timeouts, processing errors)
- Forecast accuracy (Enroute times, arrival times)
- Slot usage
- Operational practices.

A process has been established to generate Morning Brief reports for all GDP initiatives. These reports include an arrivals chart that shows whether the requested rates were achieved, as well as a summary of compliance, pop-ups, and slot usage. A configuration option enables the ATCSCC Quality Assurance Department to specify whether the reports should be generated automatically as part of FSA's nightly data processing. Reports that are generated automatically are copied to a directory on the computer FTP Server. A link to this directory from the ATCSCC web site allows anyone within the ATCSCC to view the reports.

The FSA Data Preprocessor generates daily compliance reports for FAA facilities. The reports can be generated in a Microsoft Excel or text format. By default, an Excel format is used. A configurations option allows the Quality Assurance Department to specify whether the reports should be generated and e-mailed automatically as part of FSA's nightly data processing. Alternatively the reports can be generated on demand to allow ATCSCC personnel to make adjustments to the compliance window for specific GDP airports.

Flight lists displayed are automatically updated when a new ADL is received without requiring the user to click on an update button.

6.1.13.3 Interfaces

From FSM, Post Analysis FSA reads the FSM server files.

From FSM, Real Time FSA reads the FSM server files.

From OIS, Real Time FSA obtains the Web Coversheet database.

6.1.13.4 Data Sources

The FSM historical files are the FSA's data source. The FSM historical files provide the most complete history available. However, the FSM data may be incomplete under the following circumstances: airport collection did not begin at 0800Zulu for the historical file retrieved or the historical file is missing updates due to automation problems.

6.1.13.5 Outputs

Real time FSA provides these flight lists/reports as HTML files:

- *Performance:* A list of all flights that are not arriving in the hour dictated by their control time. Flights with no Slot ID will also be listed
- *Compliance:* A list of flights that are not CTD compliant
- *Cancels that Flew:* A list of all flights that were canceled and operated without being reinstated before departure
- *Pop-ups:* A list of all flights which first appeared in the Aggregate Demand Lists after the program model time and are expected to arrive within the program start and end times
- *Morning Brief Report:* An arrivals chart that shows whether the requested rates were achieved, as well as a summary of compliance, pop-ups, and slot usage
- Daily Center/Region Compliance Reports: Compliance Distribution for specific center/region for specific date.

6.1.13.6 Reference Sources

- Web FSA 2.0 Requirements Specifications, draft, dated 05/03/02; Metron Aviation Inc., Reston, VA
- FSA 1.5 Post Analysis Release Notes

6.1.13.7 Miscellaneous

Version No: Post Analysis FSA is 2.0; Real Time FSA is 2.2.

Development Languages: Post Analysis FSA software in: Visual Basic and SQL; Real Time FSA software in: Java Script, SQL, Netscape Enterprise.

Platform: Server: NT; Client: any web browser.

COTS Products Used: SQL and Web Server.

Software Maintenance Organization: Metron Aviation Inc.

6.1.14 Flight Schedule Monitor (FSM)

6.1.14.1 Overview

Flight Schedule Monitor (FSM) provides FAA, NavCanada, and CDM airline users the ability to monitor and manage airport demand and capacity, model traffic flow management initiatives, and evaluate alternative approaches. FSM is used by the ATCSCC to model and implement both Ground Stops and Ground Delay Programs. Airline Operations Centers use FSM to assess proposed GS/GDP, develop strategies to cope with restrictions, and monitor GS/GDP initiatives that are in effect. FSM provides two main capabilities:

1. Monitor Traffic Demand - FSM presents a graphical and timeline presentation of airport demand and capacity information and contains powerful utilities for ground delay program management and analysis so users can react quickly to NAS constraints. FSM users monitor specific airports, including flights arriving at and departing from those airports. FSM displays specific flight information, airport arrival and departure rates, open arrival slots and other pertinent traffic flow information. Based on the FSM display, users can determine whether a demand/capacity imbalance exists and may choose to cancel, delay, or move flights around to keep traffic moving. Before users take any action on their flights, they can model several traffic management scenarios and view the results of the actions on their operation in a matter of seconds.
2. Manage Traffic Flow - FSM allows TMSs to plan, implement, and manage GDPs and GSs. Based on the FSM display, users can determine whether a demand/capacity imbalance exists and may choose to cancel, delay, or move flights around to keep traffic moving. FSM allows traffic management specialists to run a series of possible traffic initiatives, including airborne holding, ground delay and ground stops, to determine the best way to fix the imbalance. Once a traffic management initiative is determined, FSM will send out the parameters to the users and update its own data accordingly. Airline operations users model the effects of the traffic management initiative and decide whether to alter their own operations.

FAA currently uses FSM to implement and manage all U.S. ground delay programs. Canadian sites can also issue GDPs (though, in actuality, only Toronto does). It is recommended that all TMCs use FSM for implementing ground stops. However some do not use this tool, but instead use locally developed tools or just the phone to coordinate ground stop initiatives.

FSM is capable of operating on non-ETMS workstations and communicating with the ETMS hub site independently from standard ETMS communication processes.

Since ETMS 7.4, FSM releases follow the same release schedule as ETMS. FSM is described in Section 12 of the ETMS Functional Description document.

6.1.14.2 Functions

FSM provides two modes of operation: Live Data Mode and Historical Data Mode.

Live Data Mode is used to monitor current capacity / demand for a given airport. In this mode, demand in the flight schedule display is updated approximately every 5 minutes reflecting changes in schedule and capacity. ETMS only sends out ADL updates for monitored airports every 5 minutes, unless a GDP is issued. If a GDP is issued, ETMS will send out the GDP ADL update as soon as it can even if it falls between regular updates. In the live data mode, TMSs use FSM to model traffic management initiatives for operations planning and GDP / GS implementation. Airlines also use FSM for fuel planning, modeling substitutions, and analyzing effects of schedule changes.

The following screen capture shows the Timeline (left), Bar Graph (bottom right), Control Panel (top right), and Flight Information (middle right) areas of the FSM user interface.

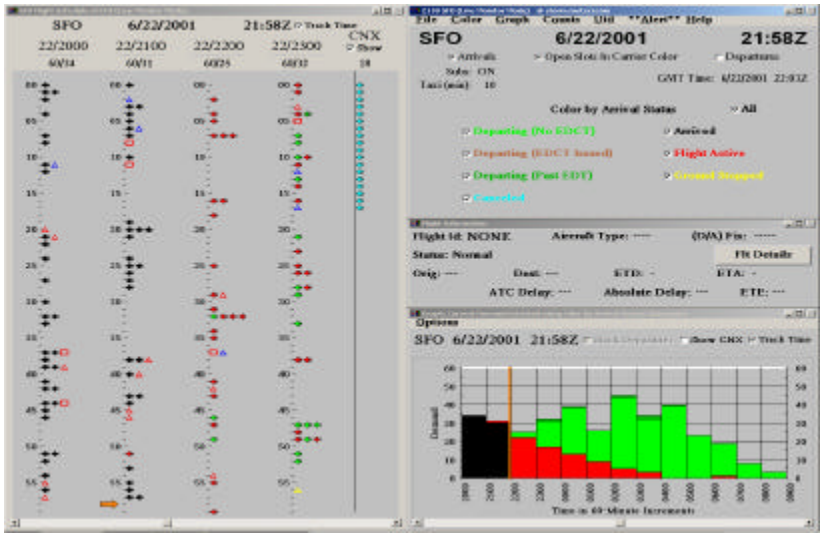


Exhibit 6-50. FSM Live Data Monitor Mode

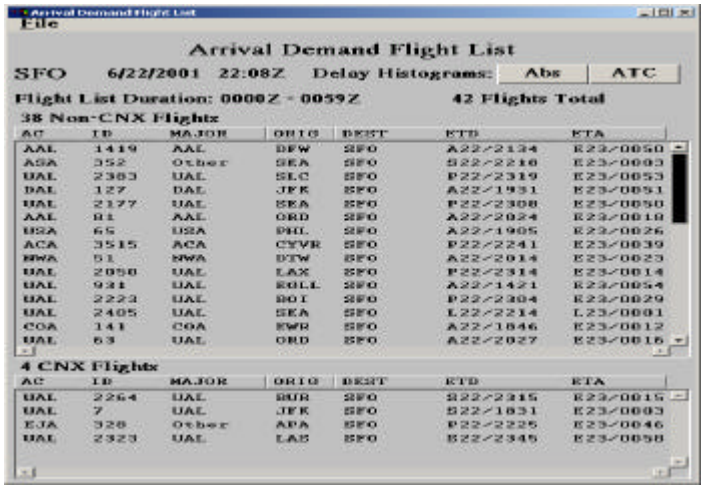


Exhibit 6-51. FSM Flight List

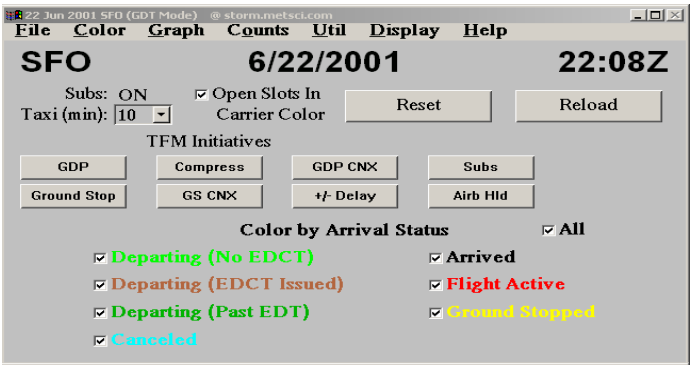


Exhibit 6-52. FSM Live Data GDT Mode

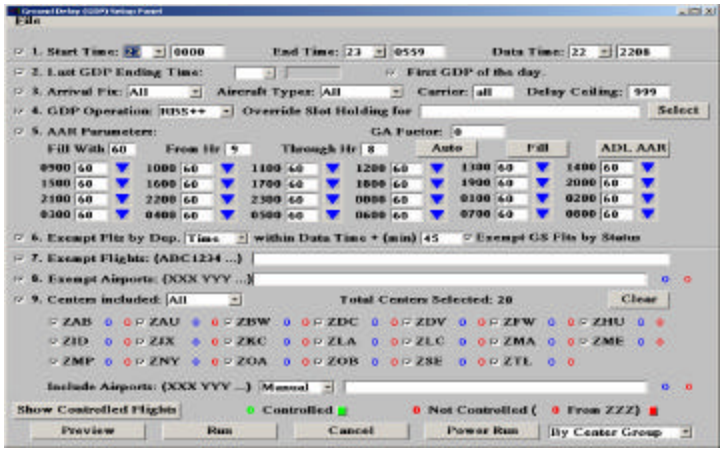


Exhibit 6-53. FSM Ground Delay Setup Panel

Historical Data Mode provides static snapshot of airport demand / capacity at one point in time. Common uses of the historical data mode include: producing daily traffic counts, replaying GDP events, and modeling alternative GDP scenarios. The Historical Data Mode interface is very similar to the Live Data Mode interface, but there are some differences such as, as shown in the following screen capture, the Demand Graph can be scrolled to the left to show the demand for hours earlier in the day (which cannot be done when in Live Mode). Also, ADL updates do not automatically occur in Historical Mode.

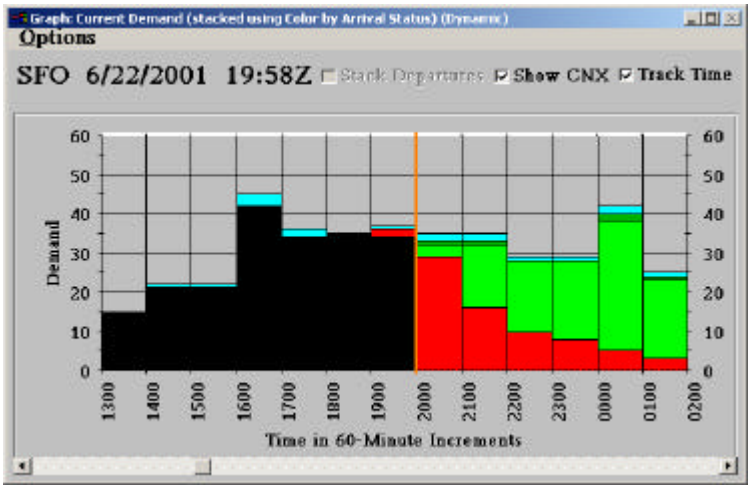


Exhibit 6-54. FSM Historical Mode Demand Graph

FSM consists of two primary components: the FSM Server and the FSM Client.

The FSM Server handles communications with the ETMS hub site and supports multiple clients. The FSM server receives Aggregate Demand Lists (ADLs) from ETMS and utilizes them to create the various data files required by the FSM client for presentation to the user. Some sites utilize multiple FSM servers for redundancy or for additional capacity to support large numbers of clients.

FSM Client – FSM Client provides the data display functions for the ADLs received from the FSM server. The Client is able to model and then transmit different types of traffic management initiatives used to manage airport demand.

FSM contains several rationing schemes that ensure that capacity and demand needs are met efficiently and equitably. Ration By Schedule (RBS) allocates airport capacity among NAS users based on their original schedule, including the assignment of capacity to cancelled flights. RBS insure that users are not penalized for having submitted schedule data or having provided cancellation information. The Compression algorithm provides a mean of reassigning flights to arrival slots in a manner that ensures scarce airport capacity is fully used. Compression fills open slots that have been created by cancelled or delayed flights.

See also the ADL product description in Section 6.2.2 and in Appendix C.

6.1.14.3 Interfaces

- From ETMS, FSM receives flight and program information via the ADLs.

- To ETMS, FSM sends GDP parameters for transferring GDP files to remote ETMS workstations. FSM also uses a remote shell process to launch ETMS Autosend (for GDP) and ETMS Email (for advisories).

- To OIS, FSM sends advisories via ETMS Email.

6.1.14.4 Data Sources

ADLs from ETMS are the data product that drives FSM. ADLs are primarily composed of data extracted from ETMS hubsite databases, which contain a combination of OAG data, airline-provided flight data messages, NAS messages generated from the ATC system, and issued ground delays (EDCTs). ADLs also include GDP-specific data entered by the traffic management specialist using FSM.

6.1.14.5 Outputs

The key displays on the FSM client are the Time Line, Bar Graph, Flight List, and Flight Information. The Time Line displays individual flights and places them on a minute-by-minute timeline. The Bar Graph displays cumulative demand as compared to capacity in various time frames (15, 30, and 60 minutes). The Flight List displays a tabular listing of data for various subsets of flights. All flight lists are based on data contained in the ADL. The Flight Information display provides two levels of flight information. The normal Flight Information display provides key data elements for quick review. A flight detailed display is also available which shows all ADL data elements for a specific flight. See screen captures above in this section.

The FSM server and client create a number of data files. Listed below are the key files, which may potentially be used by applications other than FSM:

- ADL File – Actual ADL received from the ETMS Hub
- Delta File – Difference between current ADL and previous ADL
- Historical File – Accumulated Delta files used by FSM client historical mode
- Cover Sheets – File generated for each GDP event with details of that event
- Parameter Files – File generated for each GDP event with the setting used to execute that event.
- FADT – Stranded ETMS file used by Autosend to transmit a GDP
- SCDT – Standard ETMS file used by Autosend to transmit a GDP
- Analysis File – FSM Client File with before and after of each GDP event

6.1.14.6 Reference Sources

- *Flight Schedule Monitor User's Guide, Version 1.8.3*, 3/5/02
- *ETMS Functional Description*, Version 7.4, Draft, June, 2002

6.1.14.7 Miscellaneous

Version No: FSM Server is 7.5; FSM Client is 1.8.4. (ETMS 7.5 replaces FSM C++ server with a Java server so the FSM server version is FSM 7.5).

Note: After release of FSM Java version, FSM version number will be consistent with ETMS.

Development Language: Server software is Java; Client software is C++

Platform: For ATCSCC and airlines: Sun Sparc20 or NT Pentium 200 or faster PCs. For field sites: HP 721 or faster.

COTS Products Used: Galaxy for cross platform screen management. Galaxy product is no longer supported.

Software Maintenance Organization: Metron Aviation Inc.

Training: Currently Metron Aviation conducts FSM training for airline and government and academic personnel. See Metron Aviation website http://vivaldi.metsci.com/cdm/ for training information and Airline Training Document for FSM Version 1.8.3.

6.1.15 Monitor Alert (MA)

6.1.15.1 Overview

The ETMS uses the flight event data produced during flight modeling to estimate the traffic demand at each monitored airport, sector, and fix, to generate a monitor alert whenever a traffic demand is projected to exceed a pre-defined alert threshold.

Traffic Demands are defined as follows:

- Airport traffic demands are defined as the number of arrivals and departures in a 15-minute interval.
- Sector traffic demands are defined as the peak number of aircraft in a sector during any one-minute within a 15-minute interval.
- Fix traffic demands are defined as the numbers of fix crossings within a certain altitude range during a 15-minute interval. The altitude ranges used correspond to the altitude limits of the sectors that overlay the fixes.

Note that Alert thresholds are defined in the same manner as the traffic demands.

ETMS maintains a special set of traffic demand data to support the airport ground delay program (GDP) processing. The GDP algorithms require data describing the current predicted airport demand and the original scheduled demand including cancelled flights (for airports only).

6.1.15.2 Functions

ETMS computes the traffic demands from the flight event data determined by the ETMS flight modeling based on the ETMS flight database processing. ETMS keeps a Traffic Demand Database (TDB) that contains the traffic demand count and alert threshold for each element, event type, and 15-minute interval. When a projected demand exceeds a threshold, ETMS displays an alert for that element on the TSD. The traffic manager can request data about the alert through the TSD; the alert data includes a comparison of the demands and the alerts, and flight lists for the alerted element.

There are three main functions for supporting monitor alerts: monitored elements, traffic demand processing, and alert thresholds and generation. Sections 6.1.15.21 through 6.15.2.3, respectively, describes each of these functions.

6.1.15.2.1 Monitored Elements (Airports, Sectors, Fix)

ETMS does not maintain traffic demand data for all possible airports, sectors, and fixes. Doing so would require huge processing resources and would be of questionable benefit. Rather, ETMS maintains traffic demand data only for elements determined to be of reasonable benefit to Traffic Management. The Monitored Elements list is generated according to the following

criteria; however, elements can be added to or deleted from the list according to direction from Traffic Management.

Monitored Airports consist of all US airports with *scheduled* flights, all Canadian and Mexican airports with scheduled international flights, and several manually selected international airports.

Monitored Sectors consist of all sectors in the airspace over the CONUS. The monitored sectors correspond to the sectors displayed on the TSD in the low, high, and super-high sector map overlays. A few oceanic sectors are monitored. Most are not.

Monitored Fixes consist of all fixes defined by Traffic Management as monitored fixes. They may or may not correspond to departure or arrival fixes. Furthermore, the monitored traffic for a fix consists only of those flights whose flight path actually crosses the fix; that is, arrival fix events are not passed to the TDB for inclusion in the fix counts. The traffic for a fix is maintained in categories that correspond to the sector strata that overlay the fix; that is, if a fix has low, high, and super-high sectors over it, it will have low, high, and super-high traffic counts.

6.1.15.2.2 Traffic Demand Processing

ETMS maintains the TDB so that it always reflects the state of the data in the flight database. When ETMS adds a flight to the flight database (e.g., when an FZ is received), it also adds it to the TDB. When ETMS updates a flight in the flight database (e.g., when a DZ is received), the TDB is updated immediately to reflect the new data. If a flight is cancelled in the flight database (e.g., when an RZ is received), the flight is removed from the TDB for sectors and fixes, and kept with a special cancelled flight status for airports. In every case, the information (flight ID and status) needed to update the TDB is in the flight database, or is produced by the ETMS flight modeling (the element names, event types, and event times).

ETMS maintains separate traffic demand counts for *proposed, active,* and *cancelled* (airports only). The *proposed* demand includes all flights expected to operate that are not yet active. The *active* demand includes all flights that are currently airborne or have already operated. The *cancelled* counts, which are only maintained for airports, are used to keep track of what the original demand was for an airport. ETMS uses the separate counts to distinguish alerts caused by flights in the air (active) from alerts caused by flights on the ground (proposed); the TSD displays the former as red alerts and the latter as yellow alerts.

The maintenance of the traffic demands for airports and fixes is the most straightforward, since those demands consist simply of counts of the flight events (arrivals, departures, and crossings) as they appear in the event lists. When ETMS adds a flight to the flight database, it performs a separate *add* transaction for every airport and fix event in the flight's event list. Similarly, when a flight is cancelled, ETMS performs separate *delete* transactions for each fix event. When ETMS changes a flight status or updates a flight event list, it performs a delete transaction for each previous airport and fix event, and it performs an add transaction for each updated airport and fix event.

The maintenance of the sector traffic demands is more complex than for airports and fixes because the sector demands (i.e., the peak numbers of flights at any one time during an interval) are not just counts of the sector events (i.e., sector entries and exits). To determine the peak demands, ETMS processes the sector events in pairs.

When ETMS adds a flight to the flight database, it performs an add transaction for the sector entry and exit pairs.

When a flight is cancelled, ETMS performs a delete transaction for sector entry and exit pairs.

When ETMS updates a flight's event list, it performs a delete transaction for each previous sector entry and exit pair and an add transaction for each updated sector entry and exit pair.

Traffic Demand Processing maintains minute-by-minute and 15-minute peak counts for each sector. The 15-minute peak count is determined by selecting the highest count from among each of the minutes in the 15-minute interval. ETMS maintains separate demand counts by flight status for sectors just as it does for airports and fixes. Separate minute-by-minute and peak counts are maintained for proposed, scheduled, and active counts. A total peak count is also maintained for each 15-minute interval. ETMS determines the total peak by summing the scheduled, proposed, and active count for each minute and by taking the maximum of those sums.

A flight delete transaction causes ETMS to remove the flight from the flight list, decrements the minute-by-minute demand counts, and checks to see if any peak values should be reduced.

6.1.15.2.3 Alert Thresholds and Generation

Alert Thresholds. Alert threshold is defined as the level of traffic demand required at an element for it to be brought to the attention of a traffic manager. The alert threshold is sometimes referred to as the capacity of the element or as the Monitor Alert Parameter (MAP). The numbers of arrivals and departures in a 15-minute interval (two separate values) define alert thresholds for an airport. The number of aircraft in the sector at any one time defines alert thresholds for a sector. The number of any low, high, or super-high flights crossing the fix in each 15-minute interval defines alert thresholds for a fix.

ETMS maintains two sets of alert thresholds for each element, event type, and 15-minute interval: the nominal threshold and today's threshold. The nominal thresholds are a set of default values, which are stored in a manually maintained data file and read into the TDB. Each day, ETMS uses the nominal thresholds to initially set today’s values. During the day, ETMS uses today’s values to check traffic demands and generate alerts. Authorized traffic managers can change today's values by using the CAPS command available on the TSD.

Alert Generation. ETMS compares traffic demand values to alert thresholds every minute to see if any alerts exist. ETMS generates an alert if a traffic demand exceeds an alert threshold for any 15-minute interval in the next length of time as defined by the manager (up to 6 hours for ETMS 7.5). Although the alerts are generated for excessive demands for up to 6 hours into the future, the traffic manager can view the alert status of a specified NAS element for any 15-

minute interval up to 9 hours into the future. For airports and fixes, ETMS generates a red alert only if the active demand exceeds the threshold; it generates a yellow alert if the total demand (scheduled plus proposed plus active flights) is greater than the threshold. For sectors, ETMS generates a red alert only if the active peak demand exceeds the threshold; it generates a yellow alert if the total peak demand exceeds the threshold. A traffic manager can alter the number of alerts displayed on the TSD by specifying the desired element types, or by specifying a time range for the alerts other than the one-hour default.

ETMS also detects when alerted situations are relieved. If the traffic demand is less than the alert threshold for an interval that was previously alerted, the alert for that interval is disabled. When no remaining intervals are alerted for a previously alerted element, that element disappears from any TSD that is currently displaying alerts.

ETMS also monitors whether alerts for specific 15-minute intervals have been *turned green* by authorized traffic managers. When an authorized manager has used the **Turn Green** command to indicate that an alert is being resolved for a specific 15-minute interval, the appropriate time bar interval changes color: from red to green with a red horizontal stripe or from yellow to green with a yellow horizontal stripe. The stripe indicates that there used to be an alert for the element during that 15-minute interval. This allows the user to more easily monitor that element.

If other 15-minute intervals shown on the time bar are still alerted, the alert icon on the map remains red or yellow. However, if all alerted 15-minute intervals are turned green, the icon on the map also turns green.

Once a manager turns an alerted interval from red to green, the system will not re-alert the element for that time interval, even if the situation in that interval becomes much worse. Once a manager turns an alerted interval from yellow to green, the system will re-alert the element for that time interval if the traffic situation indicates a need to upgrade to a red alert status. Also, if the Monitor Alert bar charts and text reports indicate that the situation has degraded, the manager can choose to toggle off the **Turn Green** command to indicate that the element should be monitored again. Afterwards, alerts could again be generated for the interval.

The effects of the **Turn Green** command will appear immediately on the TSD of the manager who issued the command. During the next Monitor Alert update, such effects will appear on all other TSD displays at all ETMS sites.

6.1.15.3 Interfaces

Monitor Alerts are generated by ETMS. The data ETMS uses to trigger monitor alerts are received from NAS (flight plans, amendments, departures, and track updates) and Airline flight data message updates (flight create, flight cancel, modify).

6.1.15.4 Data Sources

OAG schedule data, airline flight data messages, NAS messages, and controls issued as part of a GDP or ground stop to compute traffic demands.

OAG schedule data provides regularly scheduled airline flight information.

Airline flight data messages provide updates on what flights are operating, via flight create (FC) and flight cancel (FX) messages, and changes to the planned operation of a flight such as delays or destination changes, via flight modify (FM) messages.

NAS flight plans provide additional information on what flights are expected to operate, and most importantly, the planned routes, cruising speed, and cruising altitude. Other NAS messages, such as departure messages and track updates, are used to continually refine the demand predictions.

GDP and GS controls provide controlled departure times for the flights affected by the TM initiative. The controlled departure times supercede the scheduled and proposed departure times during ETMS flight modeling.

The ETMS map database and grid database typically contains a large number of airports, sectors, and fixes. ETMS maintains traffic demand data only for elements determined to be of reasonable benefit to Traffic Management. The monitored elements are specified in a manually maintained list.

Nominal alert thresholds are input to ETMS through manually maintained files. Daily alert thresholds are input by authorized traffic managers on the TSD via the CAPS command.

6.1.15.5 Outputs

The TSD displays alerts graphically on the screen. Additionally, the traffic manager can view traffic demands for alerted and other elements on the TSD through charts, reports, and flight displays. Traffic managers can also view Monitor Alert threshold values using the Capacity List (CAPL) report, and can modify these values using the *Capacity Set (CAPS)* function. Refer to Section 6.1.23 TSD for additional details.

6.1.15.6 Reference Sources

- *Enhanced Traffic Management System (ETMS) Functional Description, Version 7.4, Report No. VNTSC-DTS56-TMS-002,* dated June, 2002 (Draft); Volpe National Transportation Systems Center, U.S. Department of Transportation, Cambridge, MA
- Air*craft Situation Display to Industry: Functional Description and Interface Control Document, Version 4.0,* Report No. ASDI-FD-001, dated August 4, 2000; Volpe Center, Automation Applications Division, DTS-56, Cambridge, MA

6.1.15.7 Miscellaneous

Version No: ETMS 7.5

Development Languages: C, C++

Platform: HP-UX 11.0, Linux Redhat 7.1 for ETMS 7.4 (the decision to upgrade ETMS 7.5 to Redhat 7.3 is pending)

COTS Products Used: None

Software Maintenance Organization: Volpe

6.1.16 Pathfinder Web Page (PFWP)

6.1.16.1 Overview

The Pathfinder Web Page (PFWP) is designed to provide FAA users and NAS users with a shared understanding of which flights are candidates to be pathfinder flights. It is a NAS user that decides, based on pilot qualifications, aircraft equipage, and other factors, whether a flight is a candidate to be a pathfinder. In the past, there has been no satisfactory way for a NAS user to communicate pathfinder candidate flights to the FAA. The PFWP allows the airlines to enter flights so that the FAA can know, without making phone calls, which flights are pathfinder candidates.

The PFWP is available on the ATCSCC Intranet web site and is currently accessible for use by Air Carriers over CDMnet and FAA facilities over Bandwidth Manager or ADTN2000.

6.1.16.2 Functions

The PFWP presents an additional capacity to relieve congestion and reduce schedule delays during bad weather events. Users can inform the FAA about their capability to explore the routes around or through the extreme conditions by volunteering to be the "Pathfinder" by using this tool.

The PFWP consists of the following pages. At the bottom of each of the pages is the Control Panel. The Control Panel allows a user to control what data appears on the Main Page, to control how it is sorted and filtered, and to move among the various pages.

- Main Page - This shows the flights that are candidates to be pathfinders.
- Comment Page - This allows a user to edit the data for a flight, to enter explanatory comments about a flight, or to see comments that have already been entered. It also allows a user to delete a flight.
- Add Flight Page - This allows a user to add a flight to the PFWP.
- Status Page - This allows the FAA to indicate whether the PFWP is actively being used.
- Printer Friendly Page – This reformats the information in the Main Page so that it can conveniently be printed and cut-and-pasted.

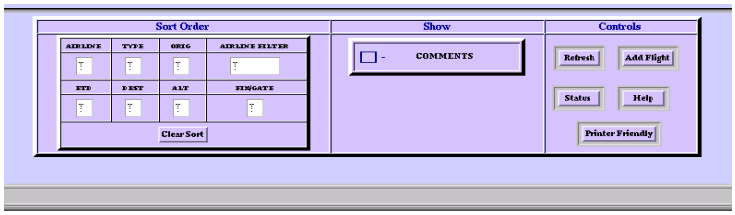


Exhibit 6-55. Pathfinder Web Page Control Panel

Main Page. The Main Page shows the basic information about the candidate pathfinder flights. The only way that a flight gets onto the Main Page is if a user manually enters it. The assumption is that every flight on this page is willing to be a pathfinder, and the FAA can choose one or more pathfinders from among these flights. See Section 6.1.1.2.18, ATCSCC Intranet Website Pathfinder Web Page for a screen capture of the Main Page.

Comments Page. The Comment Page allows a user to edit any data about a flight that has changed (e.g., EDT) or to enter/revise explanatory comments about a flight. It allows the TCA at the ATCSCC to acknowledge a new or edited comment. A user can delete a flight from the PFWP Main Page from the Comment Page. The Comment Page is accessed from the Main Page by clicking on the call sign of the desired flight.

After a comment has been added or revised, the Comment field on the Main Page displays "NEW" in red to indicate to the TCA that a new comment has been entered. After the TCA views the comment and clicks the TCA Acknowledge button, the red "NEW" in the Comment column on the Main Page is replaced by a black "Y" to indicate that the TCA has seen the comment entered by the user. A NAS user does not see the TCA Acknowledge button.

There are two situations in which a user might want to delete a flight from the PFWP.

1. To indicate that the flight has taken off.
2. To indicate that a flight is no longer considered a pathfinder candidate.

Add Flight Page. The Add Flight Page allows a user to add a flight to the PFWP Main Page. A manually added flight is removed either 60 minutes after the ETD or whenever it is manually removed with the Delete Flight button on the bottom of the Comment Page. The data on this flight will not be automatically updated by ETMS. If the data on a manually added flight changes, then the user that added it should enter the updates.

Status Page. The Status Page allows the FAA to indicate whether PFWP is actively being used to support a pathfinder event.

- Active means that a pathfinder event is in progress and that the PFWP Main Page is being monitored by the TCA. This tells NAS users that the FAA will see and act on any information added to the Main Page.
- Inactive means that no pathfinder event is in progress and that the PFWP Main Page is not being monitored by the TCA. This tells NAS users that the FAA probably will not see or act on any information added to the PFWP Main Page.

The first line of the Main Page shows whether the PFWP is active or inactive. The FAA, specifically the TCA at the ATCSCC, controls the PFWP status.

The Status Page is accessed by clicking on the Status Page button on the Control Panel. The Status Page button in the Control Panel is grayed out for NAS users, so only the TCA can access the Status Page.

Also, to make sure that the PFWP does not inadvertently stay active longer than it should, the TCA can specify how long the current PFWP event should remain active when the "Active" button is selected. When the specified time expires, the PFWP status is automatically changed from active to inactive.

Printer-Friendly Page. Since the Main Page is not convenient for printing or for cutting and pasting, the Printer Friendly Page is provided for these purposes. The Printer Friendly Page reformats the information on the Main Page so that it can be printed and cut-and-pasted conveniently. While the Printer Friendly Page is displayed, it updates just as the Main Page. The Comment and Route fields can be removed from the Printer Friendly Page by clicking the Abbreviate button. An FAA user might find this useful since, if these two fields are removed, data from this page can be cut and pasted into ETMS e-mail without one line spilling over into the next.

6.1.16.3 Interfaces

The Pathfinder Web Page does not interface with any other automated system. All data is manually entered.

6.1.16.4 Data Sources

Air carriers manually enter data via interactive web pages.

6.1.16.5 Outputs

Other than the web pages, this tool has no external outputs.

6.1.16.6 Reference Sources

- *Training Document for the Pathfinder Page, Version 1.1*, Report No. CDM-PF-TRN-001, dated 01/14/02; Volpe National Transportation Systems Center, U.S. Department of Transportation, Cambridge, MA

6.1.16.7 Miscellaneous

Version No: Version 1.1

Development Languages: HTML, Perl script, CGI script, Java script

Platform: Windows 9X/NT/2000

COTS Products Used: Information not readily available

Software Maintenance Organization: Volpe

6.1.17 Post Operation Evaluation Tool (POET)

6.1.17.1 Overview

The Post Operations Evaluation Tool (POET) is an analysis tool used by the ATCSCC, ARTCCs, TRACONs/Towers, other FAA organizations, and NAS users, such as airlines and CDM organizations, to identify and analyze air traffic control system-wide problems. The goal is for this tool to provide the means to explore what actually occurred in the NAS, as compared to what was planned, from a system perspective.

POET was developed under the CDM program with a focus on supporting analysis of NAS-wide collaborative routing problems. POET allows users to explore how the NAS functions, using a variety of performance metrics including departure, en route, and arrival delays and filed versus actually flown flight tracks. POET gets direct ETMS data feed with the data available in near real time (about 1 hour late). POET has a "rolling" 45-day data set spanning the entire NAS maintained on servers at ATCSCC and Metron Aviation Inc.

POET was deployed nationally in the spring of 2000. Recent release V2.1 included capabilities to animate CCFP data, new data mining features, and improved mapping functions.

6.1.17.2 Functions

With POET, users can easily access, filter, and visualize the flight information contained in the ETMS data archive using a variety of interactive charts, tables, and geographic displays. POET provides intuitive user interface for defining searches. Results can be aggregated into a variety of bins, including grouping by departure and/or arrival airports, filed arrival fixes, departure/arrival times, routes, departure and/or arrival centers, user class, and many more. Metrics computed for each bin include departure delay, enroute delay, arrival delay, % held (airborne), etc.

POET has built-in a collection of powerful data mining tools to assist the user in recognizing patterns and trends within the data. Some of the patterns currently recognized include circular airborne holding, arrival fix swaps, and flown routes that differ significantly from the routes filed. POET has the further capability to integrate FAA data with airline provided flight data (such as predicted vs. actual fuel consumption) when available to give a more complete picture of what is happening in the NAS.

POET and Near-Real Time POET are the same tool except that Near–Real Time POET uses data from a database populated real time from ETMS whereas POET uses an archived database.

6.1.17.3 Interfaces

- From ETMS, POET obtains data from ETMS 'rolling' 45-day database residing on servers at ATCSCC and Metron Aviation.
- From ETMS, Near-Real Time POET is populated with data from ETMS via FTM Connect.

6.1.17.4 Data Sources

POET's data source is the ETMS data that is directly fed to POET in near real time. POET also has the capability to integrate FAA data with airline-provided flight data (when available). As the ETMS data is fed into POET, an agreed upon filtering scheme is applied to protect non-FAA users from directly accessing information on sensitive flights. It also protects against accessing info on specific GA flights because they would all have the same nondescript ACID. This filtering is applied directly to the data, which prevents a user from manipulating the POET configuration to see this data. By only filtering key fields to remove sensitive flight information versus removing the entire flight record from the database, the aggregate statistics (e.g., arrival counts) remain intact.

6.1.17.5 Outputs

POET results are presented to the user via the following interactive tables, charts, and geographic displays:

- Summary Reports – Standard reports (including tables with summary statistics, charts and maps) generated in the form of a web page
- Flight-Based Data – User-entered search criteria provide detailed information about different groups of flights into or out of specific airports
- Airspace-Based Data – User-entered search criteria provide detailed information about flight that were filed or flown through a particular airspace region
- Advanced Charts – Users set parameters to create charts based on a pre-defined algorithm. The algorithm results are displayed in a specific type of chart (e.g., line chart, bar chart).

6.1.17.6 Reference Sources

- *POET Architecture* (POET Architecture_v2.doc), file date 2/8/02, Metron Aviation, Inc., Reston, VA
- *Post Operations Evaluation Tool (POET), Version 2.0, Using POET (Draft),* as modified 7/16/01; Metron Aviation, Inc., Reston, VA
- *POET Operations Evaluation Tool* presentation, dated June 2000; Metron Aviation, Inc., Reston, VA

6.1.17.7 Miscellaneous

Version No: Version 2.1

Development Languages: Visual Basic and Java

Platform: NT Client and Server

COTS Products Used: SQL

Software Maintenance Organization: Metron Aviation Inc.

6.1.18 Route Management Tool (RMT)

6.1.18.1 Overview

The Route Management Tool (RMT), formerly CDR, was developed to facilitate increased information exchange between ARTCC, the ATCSCC, and the airline user community. Coded Departure Routes (CDR) is used to reduce coordination time during severe weather or departure congestion events and to standardize route coordination for the user community.

The RMT application is client/server architecture, and can run on any platform that is Java 2 capable (e.g., HP, Linux, Windows).

RMT is a (Oracle) relational database query tool that allows users to view the centralized CDR database and related tables from the NFDC containing preferred routes and location identifiers, and airway intersection tables. Because the CDR database is centralized, there is no database discrepancy among users, thus avoiding costly miscommunication on routes.

Future versions of RMT will include other sources of routing information; for example, the National Playbook (which is now also available via the TSD at V7.4). In the U.S., ARTCCs are responsible for maintaining their own coded departure routes for severe weather and congestion avoidance procedures.

Web RMT is a searchable, web-accessible database with coded departure route, preferred route, and location identifier information used by the FAA, airlines and the public. The CDR database on web RMT can be accessed via CDMnet and via the FAA public web server (www.fly.faa.gov). Anyone can access the RMT program in this way to search the databases. However, the web version does not contain any functionality beyond searching or downloading the operational database to a file. Airlines use the web RMT version to synchronize flight planning/operational systems, and to check and correct route information being sent to ETMS or the HCS.

RMT is available in two formats: web RMT 1.2 (read-only operational version accessible from the ATCSCC Internet and Intranet websites) and RMT Version 1.1 (accessible on PCs at the ATCSCC and ARTCCs for entering CDR database changes as outlined in this section).

This tool was initially deployed in April 2000. A May 2001 release version of RMT provided the graphical display of CDRs. Future versions of RMT are expected to provide MIT monitoring, National Playbook database management, and Collaborative Convective Forecast Products display capability.

The following screen captures (from the ATCSCC public website RMT version), Exhibit 6-56. through Exhibit 6-60. , show the search and display functions inherent in the basic RMT application.

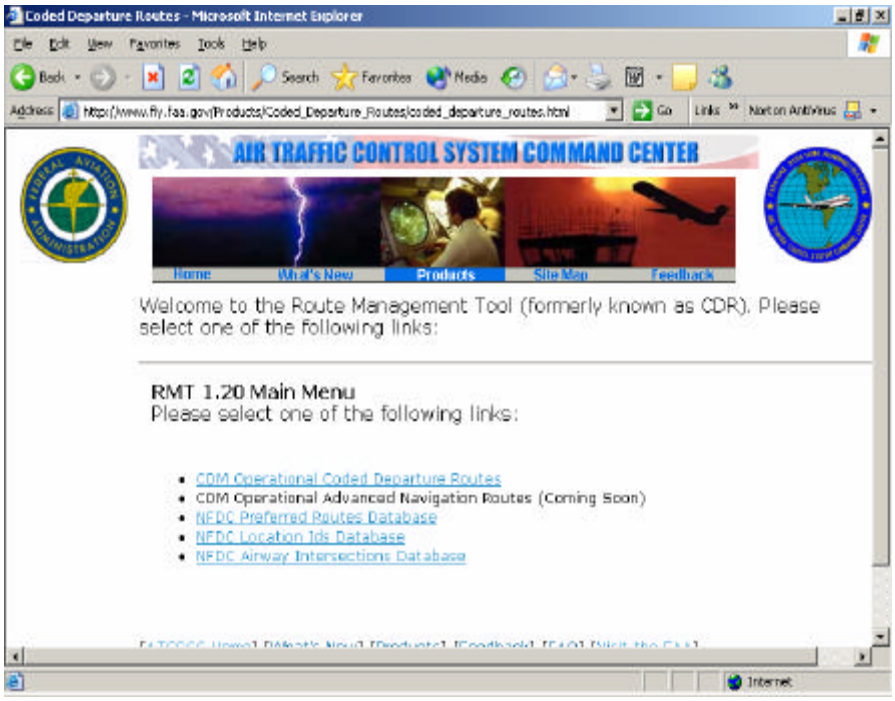


Exhibit 6-56. ATCSCC (Public) Website RMT Top Level Selection Menu

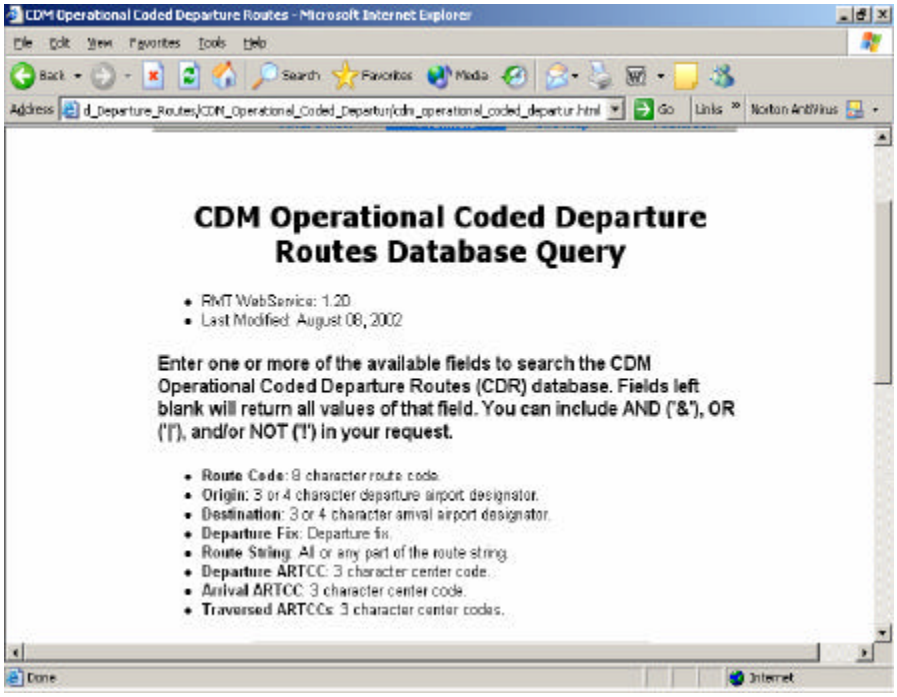


Exhibit 6-57. ATCSCC (public) website RMT CDR search interface

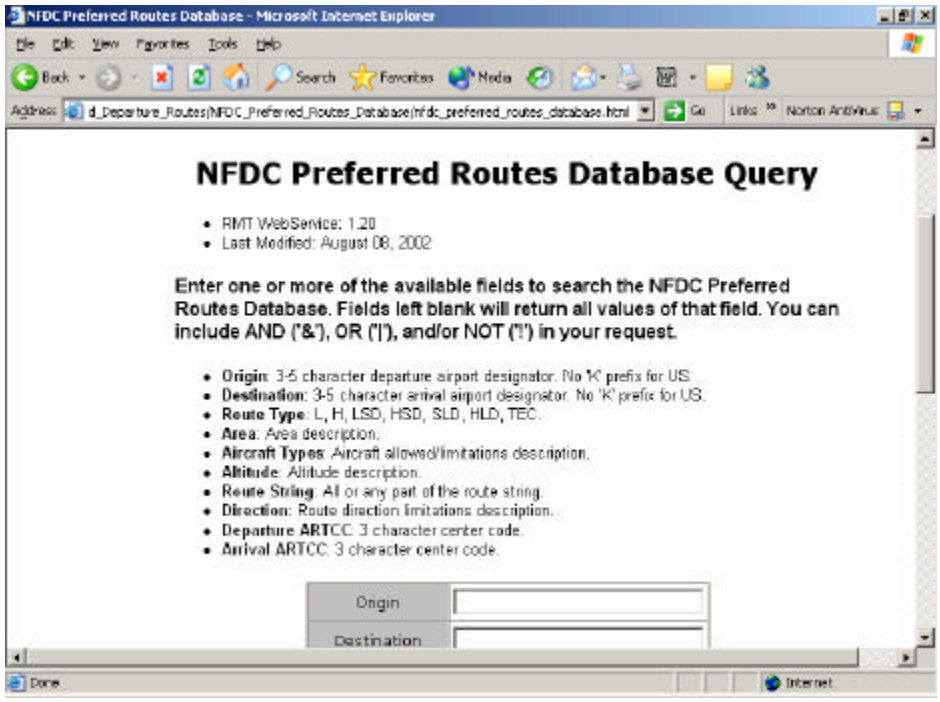


Exhibit 6-58. ATCSCC (public) website RMT NFDC Pref route search interface

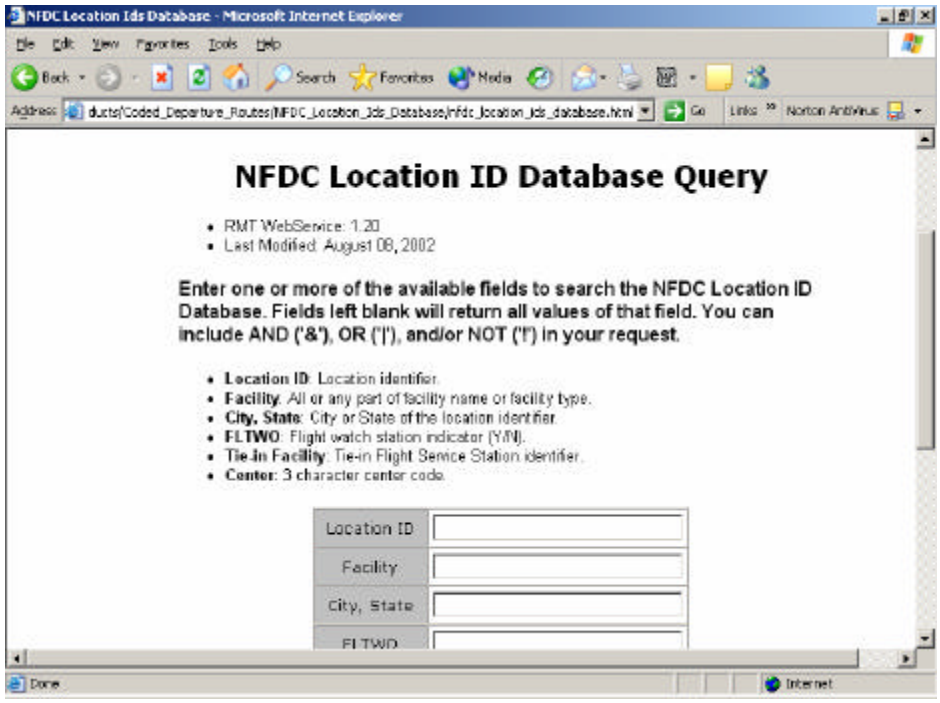


Exhibit 6-59. ATCSCC (public) website RMT NFDC LOC ID search interface

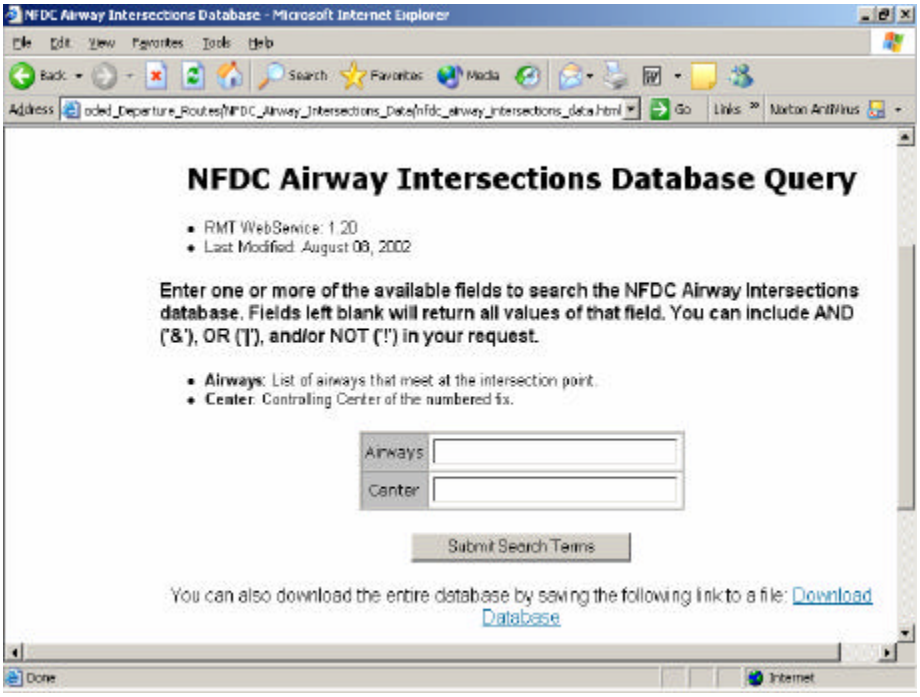


Exhibit 6-60. ATCSCC (public) website RMT NFDC Airway Intersections search interface

6.1.18.2 Functions

RMT centralizes the CDR database and allows global change on a route description element (e.g., SID / STAR numbers and jet route numbers). RMT also provides route validation as routes are modified or new routes are defined. Route string elements are validated with NFDC tables. (Note that, at this time, Canadian and Mexican data is not included in the database.)

The CDR utility in RMT is a combination of coded air traffic routings and refined coordination procedures designed to mitigate the potential adverse impact to the FAA and users during periods of severe weather or other departure congestion events.

User functions for the FAA, airline and public user are as illustrated in the public website screen captures above. Via this access mechanism, RMT users can view, search / query, and download the database.

Via the PC version, authorized RMT users can view, search / query, and download the database, and also view upcoming 56-day cycle CDR changes, and enter CDR changes according to the following schedule.

Coded Departure Routes are modified on a fifty-six (56) day cycle. The first twenty-one (21) days are the Active Period where routes can be added, deleted, or modified (by ARTCC administrators). The following five (5) days are the Verification Period where all changes are validated by the ATCSCC and ATA-100. The remaining time in the cycle (30 days) is the Quiet

Period, which allows centers and airlines to update their databases and prepare for operational use of the new set of routes. Exhibit 6-61. RMT CDR Data Flow depicts the CDR chart cycle graphically.

An overview of RMT user permissions follows:

- ATCSCC users have access to all routes and modifications in the staging and operational databases.
- ARTCC users have access to all routes and modifications in the staging and operational databases.
- Airline users have view-only access to both the staging and operational databases.
- Internet users have view-only access to the operational databases.

The ATCSCC Administrator is permitted to:

- Modify the operational and staging databases at any time
- Perform global modifications on CDRs from all centers
- Load tables from the NFDC CD

ATA-100 verifiers are permitted to modify the staging database during the Active and Verification Periods (all centers).

The ARTCC Administrator modifies the ARTCC routes for CDRs from their center in the staging database during the Active Period. Centers also define/modify Advanced Navigation Routes (ANRs) in the operational and staging databases. They are similar to CDRs.

The PC version's RMT search capabilities include search by Arrival and Departure Center, and a search using "and," "or," and 'not" operators, which is primarily used for route string elements. User preferences include screen options that are saved to a local configuration file. These options include items such as login name, window locations and sizes, font size, table columns, and overlay colors. There is also an on-line User's Guide.

6.1.18.3 Interfaces

RMT interfaces to ETMS via the centralized Oracle database that is maintained by Kenrob and Associates at the ATCSCC. This interface allows NDFC data contained in ETMS's database to be used to validate CDR entries in the RMT database, and to provide RMT user access to NFDC Preferred Route, airway and Location Identifier data.

The following graphics depict the RMT informational architecture (the CDR data flow and the NFDC data flow). All databases are housed at the ATCSCC.

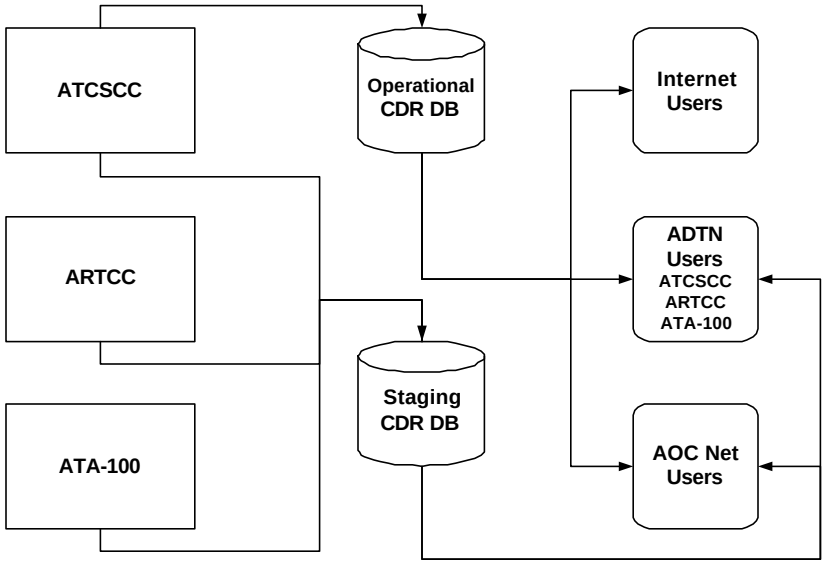


Exhibit 6-61. RMT CDR Data Flow

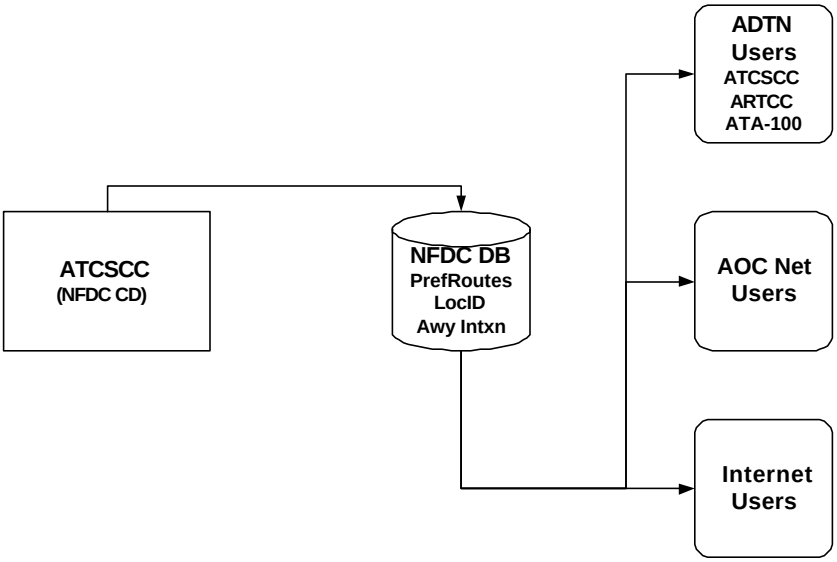


Exhibit 6-62. RMT NDFC Data Flow

6.1.18.4 Data Sources

The NFDC database furnishes:

- Preferred Routes Database
- Location Identification Database
- Airway Intersections

The CDR database is another primary data source for RMT. As of 4/18/02, there were 13,710 CDRs in the operational database.

CDRs are defined and/or modified by the Departure Center. Routes are defined between cities.

The CDR Route Code comprises 8 characters (e.g., ORDBOS1N, ORDBOS2S):

- Characters 1-3 = Departure Airport
- Characters 4-6 = Arrival Airport
- Characters 7-8 = "Assigned by" Center

ANR Route Codes also comprise 8 characters (e.g., 1NORDBOS, 2SBWIORD):

- Characters 1-2 = "Assigned by" Center
- Characters 3-5 = Departure Airport
- Characters 6-8 = Arrival Airport

Note: The above standards are not always adhered to by all ARTCCs. Airline users sometimes have difficulty determining routes to file due to this issue.

ARTCCs and NavCanada are the sources of Coded Departure Routes.

6.1.18.5 Outputs

Web browser, search only, access is available via the ATCSCC websites (Intra and Internets). From these sites, it is possible to search for routes and download the route database from the public site but not to change data in any way. See the screen dumps at the beginning of this section, and below.

Results for queries initiated through the web RMT interface are presented in tables as shown in Exhibit 6-63. Results of Web RMT Query for CDRs Between BOS and IAD.

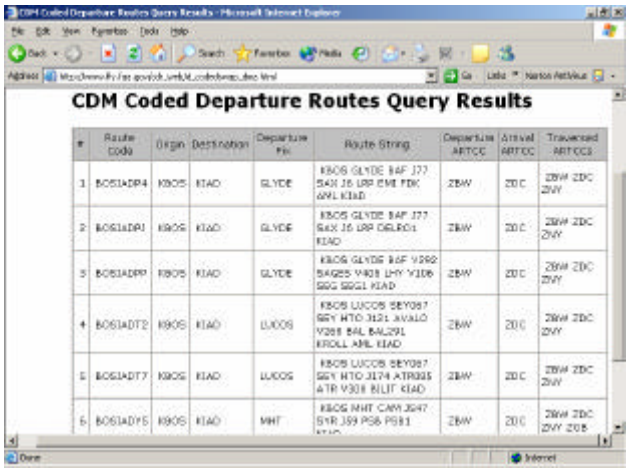


Exhibit 6-63. Results of Web RMT Query for CDRs Between BOS and IAD

The (PC) RMT Software Tool allows users to view, add and/or modify CDRs, view CDRs and Preferred Routes on a US map, and view related NFDC tables.

The RMT PC version application supports graphical display of CDRs, preferred routes, Centers that a route goes through, and miscellaneous routes, as well as an airway intersections table or unnamed, numbered fixes.

6.1.18.6 Reference Sources

- *Route Management Tool, (RMT) Version 1.1 User's Guide (Draft)*, as of 10/1/01; Metron Aviation, Inc., Reston, VA
- *Route Management Tool, Airline Training* presentation, dated October 2001; Metron Aviation, Inc., Reston, VA
- ATCSCC Intranet and Internet websites

6.1.18.7 Miscellaneous

Version No: Version 1.1 (PC) and V1.2 (web)

Development Language: Java 2

Platform: PC and web-based applications, Client/server architecture

COTS Products Used: Oracle 8.x

Software Maintenance Organization: Metron Aviation Inc. maintains the PC and web versions of RMT. Kenrob and Associates makes minor adjustments to the RMT web interface pages during RMT web page integration with OIS. Kenrob and Associates also maintains the Oracle CDR database.

6.1.19 Route Manager

6.1.19.1 Overview

The Route Manager is an ETMS application used to look up information on airports, NAVAIDs, fixes, preferred IFR routes, and weather reporting locations based on a variety of selection criteria. It provides a menu driven interface and allows the user to look up information based on an identifier or a part of the English location name.

The Route Manager can be invoked from the toolbar by clicking on the "ETMS" icon to bring up the ETMS menu. From the ETMS menu, clicking on "RMGR" starts the Route Manager application.

6.1.19.2 Functions

The main functions of Route Manager are outlined below:

- Decode an identifier (e.g., DFW, BWI)
- Encode an identifier, or part of an identifier (e.g., Bangor, Phila)
- Display preferred routes
- Display major traffic routes over a fix
- Display route parsing data
- Display expanded preferred routes.

Decode an Identifier. This option checks the specified identifier(s) against national and international listings of aeronautical locations and provides the following types of data:

- Latitude/longitude, location name, and ARTCC designator for an airport.
- Latitude/longitude and location name for a weather location, fix, navaid, or flight service station.

Encode an Identifier. This option provides the following information for one or more specified location name(s). The specified location name is its English name or a truncated part of its English name.

- Latitude/longitude, location name, and ARTCC designator for an airport.
- Latitude/longitude and location name for a weather location, fix, navaid, or flight service station.

Display Preferred Routes. This option displays data on preferred routes between specified points (i.e., origin and destination airport identifiers) and includes the ARTCCs through which

the preferred routes pass. RMT and the TSD Reroute feature provide this same function and are now the preferred method of obtaining route information.

Display Major Traffic Routes Over A Fix. This option provides information on the major traffic flows over one or more specified points. Output consists of a list of major routes that contain the specified fix. Each list item contains the route definition and its origin / destination pair.

Display Route Parsing Data. This option parses a route between one or more specified origin / destination pairs (e.g., JFK ORD) and provides the following data:

- ARTCCs through which the original route passes
- Preferred routes between the specified endpoints
- ARTCCs through which the preferred routes pass.

Display Expanded Preferred Routes. This option provides expanded data on preferred routes between two specified points (i.e., an origin / destination airport pair such as MSP ORD). The expanded data includes the following:

- FAA-assigned location code
- FAA-assigned location name
- ARTCC location
- Geographic location: city, state.

6.1.19.3 Interfaces

The Route Manager is implemented using a client-server architecture. The Route Manager client interfaces directly with the user and the Route Manager server. The server interfaces with the Router Manager data files. The Route Manager server listens for requests from the client during the time it is running. When a request comes in, the server processes the request by searching the Route Manager data files and then returns the results to the client.

6.1.19.4 Data Sources

The Route Manager application obtains geographical data from two sources:

1. Digital Aeronautical Flight Information File (DAFIF) - generated on a 28-day cycle by the Defense Mapping Agency (DMA) and delivered on a single CD-ROM. DFIF data includes international airports data, international fixes data, and international NAVAIDS data.
2. National Flight Data Center (NFDC) - delivered on a 56-day cycle by NFDC. This data covers the USA and parts of the Caribbean, Mexico, Central America, and Canada. NFDC data consists of airport data, fixes data, NAVAIDS data, preferred routes data, and weather reporting locations data.

Another data source for Route Manager is manually generated radiotelephony data. This file contains about 3600 radiotelephony handles for airlines and military outfits of various countries that fly aircraft.

Finally, inputs made by the traffic management specialist through the RMGR user interface are data sources for the Route Manager application.

6.1.19.5 Outputs

Route Manager outputs include responses to server requests that are sent to the client in an ETMS E-Mail message or via the ETMS FTP function.

Depending on the route manager option selected, the following information is output.

- Latitude/longitude, location name, and ARTCC designator for an airport
- Latitude/longitude and location name for a weather location, fix, NAVAID, or flight service station
- Data on preferred routes between specified points, including the ARTCCs that the preferred routes pass through
- Information on the major traffic flows over one or more fixes
- Route parsing data including ARTCCs that the original route passes through, preferred routes between endpoints, ARTCCs that the preferred routes pass through
- Expanded data on preferred routes between two specified points, including the following: FAA-assigned location code, FAA-assigned location name, ARTCC location, and geographic location (city and state).

6.1.19.6 Reference Sources

- *Enhanced Traffic Management System (ETMS) Functional Description, Version 7.4, Report No. VNTSC-DTS56-TMS-002*, dated June, 2002 (Draft); Volpe National Transportation Systems Center, U.S. Department of Transportation, Cambridge, MA
- *Enhanced Traffic Management System (ETMS) Reference Manual, Version 7.4, Report No. VNTSC-DTS56-TMS-004*, dated May 2002; Volpe National Transportation Systems Center, U.S. Department of Transportation, Cambridge, MA
- ETMS System Design Document (Draft), Version 6.0, Report No. Volpe Center-DTS56-TMS-008, March 1999

6.1.19.7 Miscellaneous

Version No: ETMS 7.5

Development Languages: C

Platform: HP-UX 11.0, Red Hat Linux 7.1 for ETMS 7.4 (the decision to upgrade ETMS 7.5 to Redhat 7.3 is pending)

COTS Products Used: None

Software Maintenance Organization: Kenrob and Associates

6.1.20 Runway Visual Range Web Page (RVR)

6.1.20.1 Overview

Sensors at a number of airports provide real-time measurements of runway visual range (RVR). For a fully instrumented runway, RVR values are given for the touchdown, mid-point, and rollout portions of the runway, along with an indication of whether the values are increasing, decreasing, or stationary; in addition, the status of edge and centerline lights is given.

Every two seconds, an RVR value is reported that is an average of the values over the last minute. The FAA is now providing real-time Runway Visual Range (RVR) data to FAA facilities, air carriers and the public.

The RVR system at an airport reports RVR values from 0 to 6500 feet that, roughly speaking, represent the distance that a pilot is able to see down the runway. For a fully instrumented runway, RVR values are given for the touchdown, midpoint, and rollout portions of the runway, along with an indication of whether the values are increasing, decreasing, or stationary; in addition, the status of edge and centerline lights is given. Every two seconds, an RVR value is reported that is an average of the values over the last minute.

The RVR Web Page (http://rvr.faa.gov):

- Makes visibility data available to all sites; dispatchers can see weather data at remote locations
- Is used only for situational awareness, NOT to make landing decisions
- Provides digital data feed and web-site access for airlines and
- Eliminates or reduces the number of telephone calls received by controllers and TM specialists at FAA facilities

Controllers use RVR data, which is fed directly to FAA tower facilities, for control decisions only when it is supported by visual confirmation. Pilots are therefore directed to contact the local tower for visibility numbers, rather than rely on the RVR web information.

6.1.20.2 Functions

6.1.20.2.1 User Functions

The TSD RVR product displays a text block. Users access this information from the TSD using the WX Request function to request RVR data for a specific airport.

RVR information is also available in graphical and text formats via the ATCSCC Intranet and Internet websites.

In order to access RVR data via the websites, users are required to acknowledge that RVR data available on the site is for flight planning only purposes.

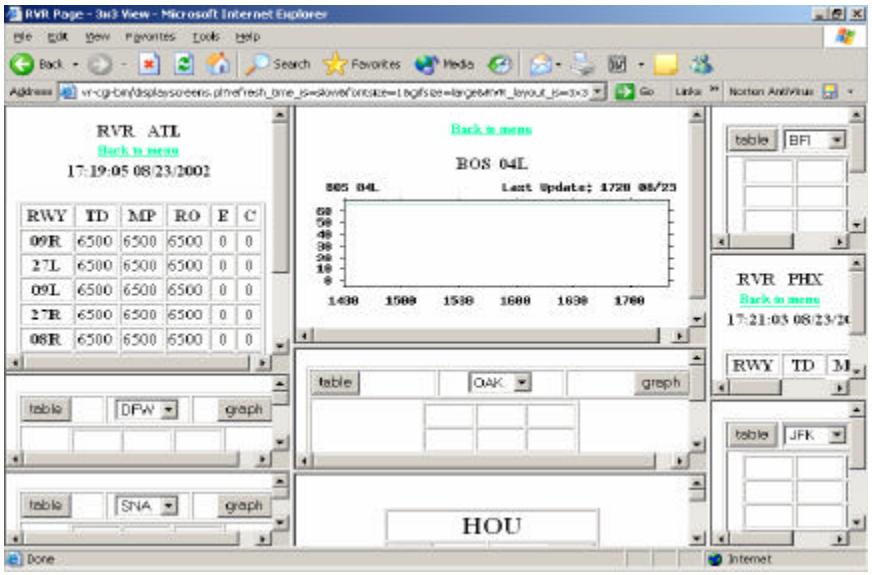


Exhibit 6-64. RVR Website Display

6.1.20.2.2 Software Functions

The RVR application software has four components that acquire and distribute the RVR data.

- *RVR TRACON Server* - Accepts RVR data reports (ADUs) from each Data Processing Unit (DPU) from the RVR sensing equipment over a serial line, error checks the validity of every field in the reports, logs any errors, reformats the reports into what is termed an augmented ADU (adds the airport ID, date, a counter, and text formats) and sends this data on using TCP/IP to any registered, connected client (in this case, the Volpe Hubsite).

  A RVR TRACON Server configuration file contains information linking/describing serial ports and airports. Each RVR TRACON server can also be set for a particular rate for receiving ADUs from the RVR sensor. The default rate is 2 seconds but this can be set to a slower rate (not faster). The RVR TRACON Server sends at the same data rate to all clients.

  ADU error logs contain the ADU that was received as well as the ID of the airport that generated the ADU and the date and time that the RVR TRACON Server received the ADU.

  Logs (containing ADUs received, error messages, successful and unsuccessful connection attempts, and closed connections) are compiled and stored hourly by the system. Logs may be examined whenever there is some problem that is being investigated.

  The RVR TRACON Server responds to ETMS statistics requests. This function can be used to identify a problem with an RVR server remotely. For example, a statistics

request for the RVR TRACON Server might be: What clients are connected, how long have they been connected, how much data have you shipped them, and what are their IP addresses? Note that provisions were made in the RVR requirements to support up to 8 clients connecting via TCP/IP to any given RVR TRACON server, however, the Volpe RVR Collector is currently the only authorized client.

- *RVR Collector* - Connects to the RVR TRACON Server at each TRACON to get the RVR data, error checks it, and passes it to the RVR Display Driver and the RVR Hubsite Server. The RVR Collector also sends a snapshot of RVR data for an airport to any Traffic Situation Display that requests it.

  The RVR Collector is responsible for maintaining a connection to the active RVR TRACON Server at every TRACON that is providing RVR data, i.e. the RVR Collector is a client that opens a socket connection to initiate a session. If this connection is lost, it is the responsibility of the RVR Collector to re-establish the connection.

  The RVR Collector logs every augmented ADU that it receives. The log is kept online for at least 3 days for trouble-shooting purposes. In addition, logs are kept for 15 days in case they are needed for some other purpose; for this longer time period.

  Every augmented ADU received by the RVR Collector is error-checked, for checksum, syntax of every field and semantics. If there is an error, the entire ADU is discarded. If the augmented ADU explicitly indicates that data is invalid or unavailable, this is not considered to be an error.

  If the RVR Collector finds that an augmented ADU is error-free, it passes the augmented ADU to both the RVR Display Driver and the RVR Hubsite Server.

  If the RVR Collector receives a request from a TSD for RVR data for an airport and if the stale data time-out period has not passed since the last valid augmented ADU was received for that airport, the RVR Collector returns the most current RVR data for that airport to the TSD. If the stale data time-out period has passed, then the RVR Collector sends the TSD a message saying that data is not available for that airport.

  The RVR Collector also responds to ETMS statistics requests.

- *RVR Display Driver* - Receives clean RVR data from the RVR Collector and posts it to the browsers of authorized users who are monitoring the RVR data.

  The RVR Display Driver makes the RVR data available via a web browser to any airline or other authorized user with access to the Volpe CDM DataGate Intranet website. Currently, the ATCSCC, Volpe and air carriers that participate in the CDM Program and the ATCSCC have access to the CDM DataGate. The data also becomes available for viewing via the RVR Internet site.

  On the Volpe CDM DataGate Intranet site, the RVR Display Driver allows the user to specify the airports for which RVR data is displayed. The RVR Display Driver also

allows the user to request the rate at which the RVR values will be updated for an airport. At a minimum, the update rates offered are every 2, 10, or 60 seconds. For example, suppose that a user requests 10 seconds as the update rate. This means that when the RVR Display Driver receives an update for an airport that this user is monitoring, it will only send that update if at least 10 seconds have elapsed since the last update was sent to that user. If the user requests a faster rate than the rate at which the data is being provided, then the user will not receive updates at the requested rate. This functionality allows a user that is short on bandwidth to specify a slower rate to conserve bandwidth.

The RVR Display Driver updates the user's display of the RVR data for an airport at either the update rate requested by the user or at the update rate provided by that airport, whichever is slower. For example, if the RVR TRACON server is configured to provide updates every 2 seconds, and if the user asks to get updates every 2 seconds, then in fact the user will receive an update every 2 seconds. If, instead, the RVR TRACON server is configured to provide updates every 10 seconds, and if the user asks to get updates every 2 seconds, then the user will receive an update every 10 seconds. In other words, the user can ask for an update rate, and the RVR Display Driver will come as close to meeting it as possible, given the rate at which the RVR TRACON Server sends the data.

The RVR Display Driver provides the following data for each airport.

- Airport ID
- Date and time of the update that is displayed.

All additional data included in the augmented ADU as follows:

- Runway ID for each runway
- Touchdown, mid-point, and roll-out RVR product for each runway
- Touchdown, midpoint, and rollout RVR trend indicators for each runway
- Edge light setting for each runway
- Centerline light setting for each runway.

This is the same data received and sent on by the Hubsite server and the RVR Collector process. All of this data comes from the augmented ADU. All dates and times are in Universal Coordinated Time. The times in the augmented ADUs from different airports might well differ by several minutes since the clocks in DPUs at different airports are not perfectly synchronized.

When the RVR Display Driver receives an update for an airport, it causes that data to be displayed until the next update for that airport comes in or until the stale data time-out period has passed. The stale data time-out period for an airport is 30 seconds or twice the interval at which augmented ADUs are being sent for that airport, whichever is larger.

If the stale data time-out period has passed since the RVR Display Driver received the last update on an airport, it removes the data for that airport from the display and indicates that RVR data is not available for that airport. (The message "Data Not Available" is posted.)

The RVR Display Driver also allows the user to specify runways for which the Display Drive displays a graph showing the touchdown, midpoint, and rollout values for the last hour. This functionality provides the user with a much better situational awareness with respect to RVR.

Capabilities of the RVR Internet website interface are described below under the Outputs section. Users cannot specify the update rate via the website. All data is updated at a uniform rate, every 5 minutes.

- *RVR Hubsite Server* - Receives clean RVR data from the RVR Collector and provides it to authorized users.

  The RVR Hubsite Server has a configuration file that specifies the IP addresses from which clients are allowed to connect. This configuration file allows Volpe to control who can make a socket connection and get the digital RVR data. Air carriers or vendors need to sign an MOA before they will be allowed to connect to receive the digital feed via CDMNet.

  It is the RVR Hubsite Server that allows clients to connect over CDMnet and over ETMS communication lines. This server allows any client to connect that follows the protocol in the RVR Interface Control Document and whose IP address is included in the configuration file.

  The RVR Hubsite Server provides three ports to which clients can connect, each at a different update rate. The port that provides the fastest update rate gives the client the option of registering to receive all data or just to receive the data when it changes. For the other two ports, any client that registers will receive all the data at the speed provided by that port.

  The RVR Hubsite Server also responds to ETMS statistics requests.

NOTE: The terms RVR TRACON Server, RVR Collector, RVR Display Driver, and RVR Hubsite server are used to indicate the areas of functionality that are provided.

6.1.20.3 Interfaces

The ETMS acquires RVR data from airports that have the New Generation RVR system. These airports feed the RVR data to one of the currently thirty-two (32) TRACONs that are ETMS remote sites. These TRACONs were chosen because communications lines already existed between the TRACON and the ETMS Hubsite at Volpe. From the ETMS Hubsite, data is distributed to the end users at FAA facilities and at air carriers both through a digital data feed and also through a web page located at the ATCSCC. The Traffic Situation Display is the primary user interface to ETMS.

See the ETMS to NGRVR Interface description in Section 4.6.1.13 for further details.

- *RVR TRACON Server* - The RVR TRACON server runs on an ETMS fileserver at a TRACON.
- *RVR Collector* - Makes a TCP/IP socket connection to the RVR TRACON Server at each TRACON to get the RVR data. The RVR Collector runs at the ETMS hubsite.
- *RVR Display Driver* - The RVR Display Driver runs at the ETMS hubsite.
- *RVR Hubsite Server* - The RVR Hubsite Server runs at the ETMS hubsite. Authorized users connect via a TCP/IP socket connection.

The RVR data flow is depicted in Exhibit 6-65. RVR System Data Flow.

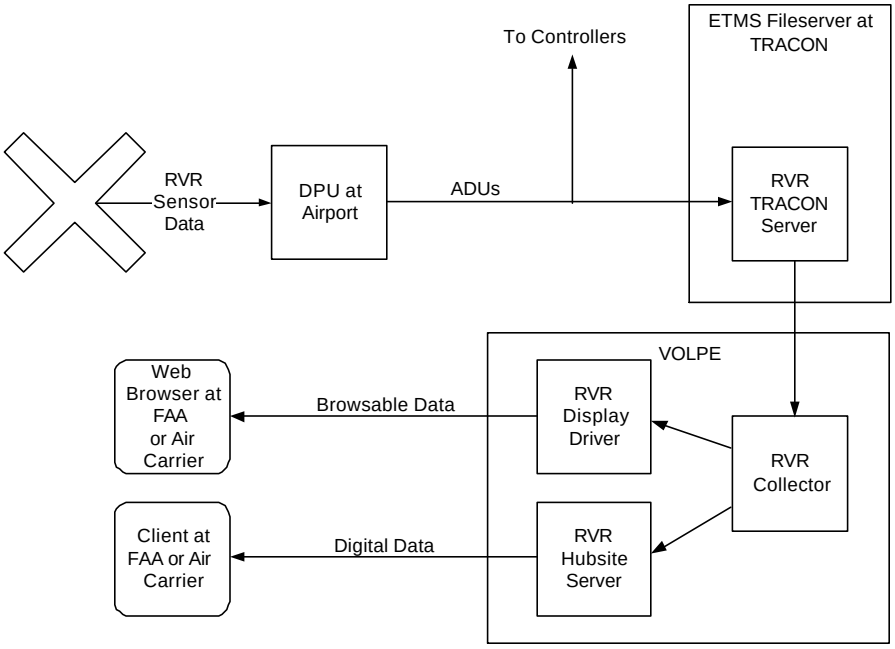


Exhibit 6-65. RVR System Data Flow

6.1.20.4 Data Sources

Sensors at an airport measure visibility, ambient light, and runway light intensity. Data from these sensors go to the Data Processing Unit (DPU) at that airport, which uses these measurements to calculate the RVR values. Every two seconds the DPU produces a data structure called an application data unit (ADU), which contains the time that the ADU was produced, a checksum that is used for error-checking, and the following data about each runway at the airport.

- Runway identifier, e.g., 26L.
- RVR value at the runway touchdown point, and the trend of that RVR.
- RVR value at the runway midpoint, and the trend of that RVR.
- RVR value at the runway rollout point, and the trend of that RVR.
- Setting of the runway edge lights.
- Setting of the runway centerline lights.

If a runway is not fully instrumented, e.g., if there is no visibility sensor at the rollout point of the runway, then some of this data might not be included in the ADU. The ADU indicates if the DPU either did not receive data for a field or that the data was invalid.

The ADU is the data that goes to the controllers in the tower and the TRACON. The ADU, when augmented with the airport ID and the date, is also the data that is captured for distribution to other FAA facilities and to air carriers on the RVR Web Page.

6.1.20.5 Outputs

RVR data is available on the TSD using the WX Request function.

RVR data is also viewable by specialists, airlines, and the public at the http://rvr.fly.faa.gov/rvr/ website and by authorized users at the Volpe CDM DataGate website.

Public website users can select up to 9 airports to view RVR data for at any one time, and configure the display of that data (using Table Update Rate, Graph Size and Screen Layout option settings). For each airport selected, from the drop down menu of airports where RVR data is being collected, data can be displayed graphically or in table format. The data is updated every 5 minutes. Exhibit 6-66. RVR Website Airport RVR Data Display Options (Table and Graph) is an example of the displays.

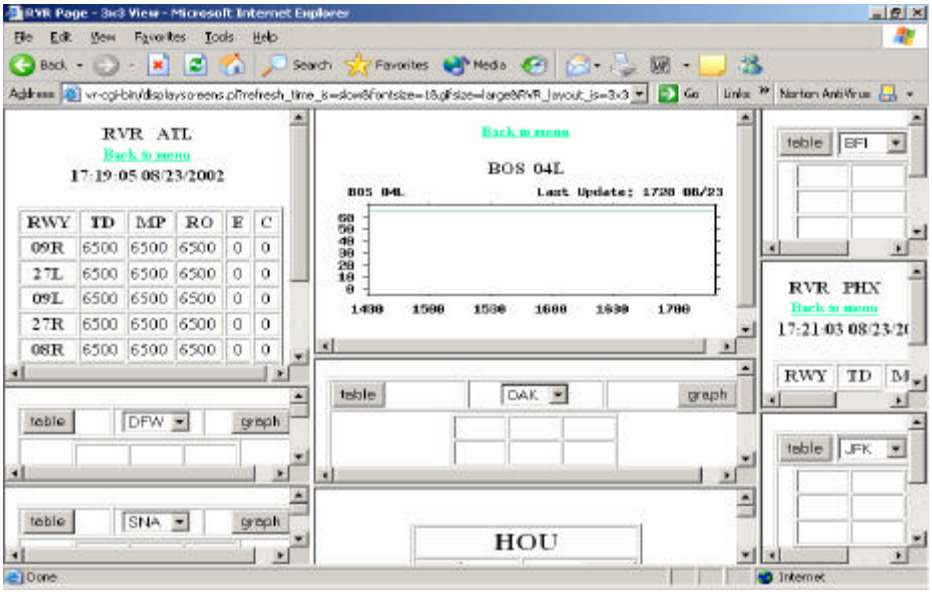


Exhibit 6-66. RVR Website Airport RVR Data Display Options (Table and Graph)

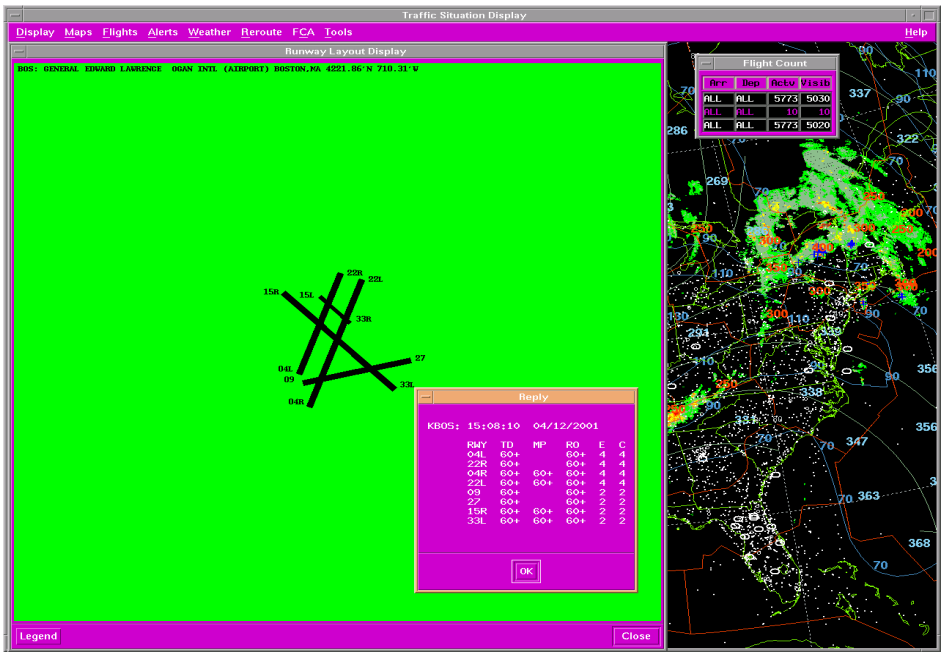


Exhibit 6-67. ETMS TSD RVR Display

6.1.20.6 Reference Sources

- *System Requirements Document: Acquiring and Distributing Runway Visual Range Data, Version 1.2*, Report No. CDM-RVR-SRD-001, dated 12/23/00; Volpe National Transportation Systems Center, U.S. Department of Transportation, Cambridge, MA
- RVR (public) Website http://rvr.fly.faa.gov/rvr/

6.1.20.7 Miscellaneous

Version No: 1.2

Development Language: C

Platform: HP**,** HTML

COTS Products Used: None

Software Maintenance Organization: Volpe

6.1.21 Traffic Management Log (TMLog)/National Traffic Management Log (NTML)

6.1.21.1 Overview

TMLog, being renamed National Traffic Management Log (NTML), is designed to replace the current FAA workload-intensive process for entering local traffic management facility operational data into multiple systems. It provides single-point, automated collection and real-time distribution of NAS operations causal data over the ETMS. Its other primary purpose is to serve as an automated restriction coordination medium between the ATCSCC and local facilities.

The TMLog program was developed by the ATCSCC to accommodate long-standing needs for:

- The sharing of log and coordination data between all air traffic facilities in the US over the ETMS national network
- Greatly reducing manual data entry for Restriction / Ground Stop / Ground Delay coordination process
- A single point of data entry for logging
- Standardization of log entries across NAS

TMLog is currently in use at the ATCSCC as well as thirteen other NAS facilities. The program is designed to save time for the specialist by allowing quick entry of log data and traffic management requests, via standardized templates. As much basic and common information as possible is pre-defined to reduce redundant entries by specialists, and maintain log consistency throughout NAS. The data collected via the TM Log program is based on information that, in most facilities, is manually entered in FAA form 7230-4, the operational position log. TM Log also automates and documents the TMU / ATCSCC restriction coordination process.

TMLog can be invoked from the toolbar via the ETMS menu. TMLog can also be started by clicking on the TMLog icon on a desktop PC.

6.1.21.2 Functions

TMLog is a data warehousing communications system used to assist Traffic Management specialists in the recording of their daily activities.

The TMLog allows specialists to configure their own interface (to display only templates they use on a regular basis), to view log data at another position or to ‘subscribe’ to see template entered information made at other facilities, to receive notification that some kinds of entries have been made elsewhere, and to coordinate restrictions between a facility and the ATCSCC in a standardized, self-documented manner. The system administrator has rights to add new users and to determine what privileges (based on site and position) users have within the TMLog application. For instance, ATCSCC specialists can approve, modify or disapprove a

restriction request from a facility. Facility specialists can only request, modify or cancel a restriction or restriction revision.

From a user perspective, TMLog currently offers the template functions itemized on the tabs in Exhibit 6-68. National Traffic Management Log Interface – Delay Template.

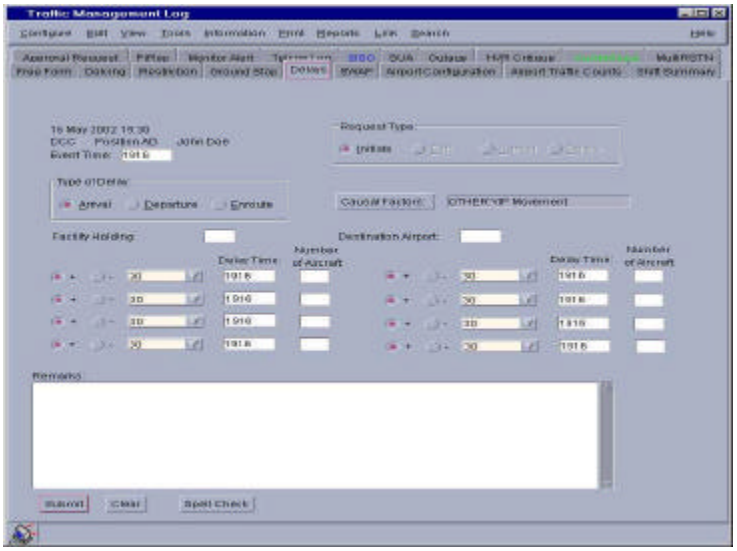


Exhibit 6-68. National Traffic Management Log Interface – Delay Template

6.1.21.3 Interfaces

TMLog interfaces with the Flight Schedule Monitor (FSM) and ETMS Email. FSM sends Advisories and Ground Delays (EDCTs) to TM Log via ETMS Email.

TMLog will also interface with OPSNET for delay and traffic count data acquisition, and potentially other systems, as its development evolves. For instance, the NTML Work Group is investigating the possibility of providing a TMLog Oracle portal to ESIS.

6.1.21.4 Data Sources

Primary data sources for TMLog currently include FSM (automated) and TMLog GUI entries (manual) made by specialists.

The following templates are available in the current version of TMLog:

- SISO – is the log in screen interface. Specialists must log into and out of NTML using their unique operating initials which, along with their site/user permissions must be configured by the TMLog system administrator.
- Free Form - permits a wide variety of general entries and ad-hoc comments. Free Form Log entries can be addressed and forwarded to ensure that specific facilities or positions receive rapid notifications.

- Deicing - makes log entries regarding deicing status. If a facility is a participant in a predefined deicing program, the system will process that information as required.
- Restriction - coordinates restriction activities, including approval requests, change requests and cancellations. Data entered into this template includes all critical information required to approve or deny restrictions across the NAS. Internal restrictions may be entered without prior approval from the ATCSCC.
- Ground Stop - records log entries regarding short term Ground Stops. National Ground Stop and EDCT are entered into the logs automatically by the Flight Schedule Monitor (FSM) that calculates Ground Stop and EDCT parameters.
- Multiple Delays - records when a facility is in delay status. The number of aircraft affected by the delay is also entered here. A maximum of eight delays may be entered for one airport.
- Severe Weather Avoidance Program (SWAP) template - records whenever a facility enters or exits its SWAP condition as well as its route status.
- Multiple Airport Configuration - records local airport configuration entries, including runways, approach type, and the navigational aids in use. Configurations for multiple airports may be entered simultaneously. See Figure 6.7.x-2 below.
- Airport Traffic Counts - records required arrival and departure information for local airports during the hours EDCT is in effect.
- Shift Summary - used frequently throughout the shift to record a variety of activities
- Monitor Alert - used to record alerts, specific actions taken, as well as the time and sequence of events associated with the alert.
- Approval Request - used to allow the entry of approval request records.
- Pilot Report (PIREP) - used to record any ancillary information relevant to pilot reports.
- Telcon Log - used primarily by the ATCSCC to log participants in various scheduled and ad hoc telephone conference calls.
- Historically Validated Restrictions (HVR) Critique - used by the command center to review regularly recurring restrictions and make assessments or modifications on a periodic basis.
- Special Use Airspace (SUA) – used for viewing and adding SUA information.
- Outage – facilitates the advanced scheduling and coordination of activities concerning the temporary loss or availability of certain ATC components such as sectors, meter fixes and runways.
- Multiple Restrictions (MultiRSTN) - allows the TM log users to schedule up to 10 individual restriction activities simultaneously. These restrictions may include approval requests, change requests and cancellations.

Exhibit 6-69. NTML Multiple Airport Configuration Template (Proposed) illustrates the interface for Multiple Airports Configuration data entry, which should be implemented by October 2002.

Exhibit 6-69. NTML Multiple Airport Configuration Template (Proposed)

6.1.21.5 Outputs

Log entries are displayable on the NTML display when selected for viewing.

A separate notification window lists the number of incoming entries not yet viewed, for several different critical entry types, including Restrictions.

Three Log program reports are available for output to a configured printer, including:

- Facility Reports
- Position Reports
- Log History Reports

There is also the capability to generate customized queries by selecting the following criteria:

- Date Range
- General Search
- Free Form
- Deicing

- Restriction
- Ground Stop
- Delays
- Severe Weather Avoidance Program
- Airport Configuration
- Airport Traffic Count
- Shift Summary
- Approval Request
- Pilot Report
- Monitor Alert
- EDCT
- Outage
- SUA
- HVR Critique

6.1.21.6 Reference Sources

- National Traffic Management (TM) Log Program Reference Guide, Version 2.6 for *Enhanced Traffic Management System (ETMS)*, May 29, 2002, CSC/E3-01/N0098
- CSC Internal Document - *Multiple Airports Configuration Template Requirements* notes, dated May 24, 2002

6.1.21.7 Miscellaneous

Version No: TMLog 3.01

Development Languages: Java 1.3.1_02

Platform: HP-UX 11.0, Red Hat Linux 7.3, Windows 9x/NT/2K

COTS Products Used: Oracle 8i database and SQLJ, Java, Java Foundation Classes, Java Remote Method Invocation (RMI), JDBC and embedded SQL, SAX, Antlr Java parser generator, Sentry Spell Check Engine

Software Maintenance Organization: Computer Sciences Corporation (CSC)

6.1.22 Traffic Management Shell (TMShell)

6.1.22.1 Overview

The Traffic Management Shell program is an ETMS application used by traffic managers to issue many of the non-graphical commands available in the TSD without any of the graphical displays (overlays, boundaries, flights, etc.) ever appearing. This includes access to the ETMS List Server and EDCT functions. List Server enables users to generate flight reports, fix loading reports, flight plan reports, arrival delay prediction reports, and time verification reports. The TM Shell also provides other commands that are not available through the TSD.

The TM Shell can be invoked from the toolbar.

6.1.22.2 Functions

The TM Shell allows the traffic manager to enter individual commands and run script files.

TM Shell provides many available functions through the command line interface. Following are some of the available functions. For a complete listing of commands and their descriptions, refer to the *ETMS Reference Manual.*

- Display the current date and UTC time
- Make EDCT requests to the EDCT server and retrieve the report names
- Display a list of available commands
- Display help for individual commands
- List all reports in the default report directory
- Purge the report directory according to specified purge criteria
- Specify timeout parameter values
- Display the current version of TM Shell
- Make weather requests and produce weather reports and terminal forecasts
- Query the FTM program to list all legs of a flight for up to ten aircraft IDs, or to show all data for up to five flights per query request (FTM is an ETMS program that maintains the database of flight information for display on the TSD.)

Some of the TM Shell commands are available only at the ATCSCC.

The TM Shell program includes configuration files that allow the traffic manager to customize certain features. In addition, TM Shell can execute scripts to request flight reports automatically on a scheduled basis.

6.1.22.3 Interfaces

The TM Shell interfaces with the ETMS List Server to access the Flight Table Manager for flight reports, the OAG schedule of flights. It relies on the EDCT communications server in ETMS for the EDCT data, and on the Weather Distribution server for weather reports and forecast data. TM Shell also interfaces directly with the FTM server to get information on specific flights.

6.1.22.4 Data Sources

Data inputs to the Traffic Management Shell include configuration files, TM Shell report files, and command line user interface input. In addition, data sources for responses to TM Shell commands include the List Server, EDCT Server, Weather Server, and the FTM.

6.1.22.5 Outputs

TM Shell outputs consist of responses to the entered commands. TM Shell outputs are displayed on the user interface and may also be printed using the print command. Depending on the command line arguments that are entered, the print command may be used to print the specified file, the last report on the specified site, or the reports on all active sites.

6.1.22.6 Reference Sources

- *Enhanced Traffic Management System (ETMS) Functional Description, Version 7.4, Report No. VNTSC-DTS56-TMS-002*, dated June, 2002 (Draft); Volpe National Transportation Systems Center, U.S. Department of Transportation, Cambridge, MA
- *Enhanced Traffic Management System (ETMS) Reference Manual, Version 7.4*, Report No. VNTSC-DTS56-TMS-004, dated May 2002; Volpe National Transportation Systems Center, U.S. Department of Transportation, Cambridge, MA
- *Draft ETMS System Design Document, Version 6.0*, Report No. Volpe Center-DTS56-TMS-008, dated March 1999; Volpe National Transportation Systems Center, U.S. Department of Transportation, Cambridge, MA

6.1.22.7 Miscellaneous

Version No: ETMS 7.5

Development Languages: C

Platform: HP-UX 11.0, Red Hat Linux 7.3

Software Maintenance Organization: Computer Sciences Corporation (CSC)

6.1.23 Traffic Situation Display (TSD)

6.1.23.1 Overview

ETMS displays data to the traffic manager through the TSD in four general forms: graphics drawn on a map, text reports, and alert and FEA/FCA time lines and bar charts. The TSD may display data automatically or only when requested by the traffic manager, depending on the data type. The TSD provides four ways for the traffic manager to request data and control the way the data is displayed: menus, dialog boxes, keyboard commands, and semicolon commands.

The TSD displays traffic situation data graphically on the screen overlaid with geographical, weather, alert, reroute, and FEA/FCA data as directed by the traffic manager, who can turn the data on or off using a menu or keyboard command. Once the data is turned on, the TSD automatically refreshes the display with the latest flight positions until the traffic manager turns it off. Other menu and dialog box entries, keyboard commands, and semicolon commands allow the traffic manager to control which flights and data are displayed. The TSD can also replay traffic situation data with alert and weather data up to 6 hours, as requested by the traffic manager.

6.1.23.2 Functions

The traffic management specialists use the TSD to view air traffic in a variety of modes. For example, nationwide, regional, or local airport traffic can be viewed, and weather features affecting the traffic can be displayed. More specifically, the TSD provides the following information:

- Geographical data, including map overlays of airports, NAVAIDs, fixes, airways, latitude and longitude grid, ARTCCs, sectors, TRACONs, and Special Use Areas
- Flight data
- Alerts
- Weather data
- Reroutes
- FEAs/FCAs
- List Reports

6.1.23.2.1 Geographical Data

The TSD displays geographical data graphically on the screen when requested by the traffic manager. The TSD can overlay various geographical data types with each other and with traffic situation, alert, reroute, FEA/FCA, and weather data. The traffic manager can request map overlay displays by using dialog boxes and keyboard commands. All geographical data is included in the Maps Database.

The TSD displays geographical data, specified in spherical coordinates (i.e., latitudes and longitudes), on an essentially flat screen. To do so, the TSD projects the spherical coordinates onto a plane using a *Lambert Azimuthal Equal-Area Projection (LAMP)*. The LAMP is a conical projection, which intersects the earth in a circle with a given center point. Traffic managers can choose one of five center points for the projection: one appropriate for the contiguous United States (CONUS), Alaska, Canada, England, and the Atlantic Ocean. The LAMP is best suited for showing a large rectangular area with minimal distortion. Therefore, the LAMP as used by the TSD provides a reasonably small amount of distortion over a large geographic area around the center point of the projection at the expense of extreme distortion for other parts of the world.

Being an equal-area projection, the LAMP shows geographic areas according to their proper relative sizes (e.g., a region that looks twice as big as another is really twice as big as the other). The LAMP shows true directions from the center point. Note that the projected coordinates are used only for displaying the data. The internal representation of the geographical data used in flight path processing is in spherical coordinates and does not contain any distortion.

The TSD draws map overlays on the display as follows. For elements defined by a point (e.g. NAVAIDS, fixes, airports), the TSD draws the element icon at the projected latitude and longitude of the element. Circle icons are used for airports. Triangular icons are used for other elements of this type. The location identifier (label) is drawn for these elements to the right of the element icon. For elements defined as an area (e.g. sectors, ARTCCs, SUAs), the TSD draws the boundaries using solid lines. The TSD determines an approximate center point to draw the label for this element type so that its lower left corner is at that point. By using a dialog box, the user can specify icon colors of map overlays and the fonts and sizes of the element labels.

6.1.23.2.2 Flight Data

ETMS generates a traffic situation update for the TSD every minute. The update contains an entry for every flight in the flight database that is currently marked active. Each flight entry includes the flight ID, aircraft type, altitude, speed, heading, Field 10, waypoints, and estimated position. When a traffic manager requests the display of traffic situation data, the TSD automatically updates the display according to parameters selected by the traffic manager. These parameters control which flights are displayed, the color and icon used to draw them, and the data displayed for those flights.

The TSD shows a flight on the display by drawing an icon at its estimated position. The user can select the flight icon shape and color used by the TSD. The user has a choice of three icons: dot, airplane, or automatic. When the dot is selected, the TSD uses the dot icon unless the zoom scale is less than 850, in which case the TSD uses the airplane icon. When the airplane is selected, the TSD uses an icon shaped to resemble a jet aircraft at all zoom scales. When the automatic icon is selected, the TSD shows the flight as a wedge shaped airplane icon for heavy aircraft or a straight winged airplane icon for the prop aircraft type. Otherwise, the TSD shows the flight using the airplane icon. When the TSD draws the aircraft icons, the icons point in the approximate directions that the flights are heading.

The TSD alters the user-selected icon shape under three conditions. A flight designated in the FDB as *holding* appears on the display as a racetrack icon. The holding designation may have been entered into the flight plan when filed or by an airborne control, or may have been detected by the FDB from the flow of TZ messages. A flight designated as *ghosting,* which is further described in subsequent paragraphs, appears as a hollow (outlined) icon instead of a solid (filled) icon. A flight that has *landed* appears on the display as a circle icon.

In addition to the icon, the flight may be drawn to show other data. For instance, a data block that contains the flight ID, speed, altitude, aircraft type, and minutes to destination may be shown for each flight. The data block may also contain the origin and destination or the Field 10 (route) data. The flight may be drawn showing its route, last reported position (Last TZ), and/or the history of previous flight positions. By using a dialog box, the user may specify the font and size of the data block. The data block is drawn above and to the right of the flight icon; however, the user may drag the data block to a new location relative to the flight icon to make it easier to read.

The TSD provides the user with multiple ways to control how flights are drawn. Except for the icon shape and color, the display characteristics of all flights may be changed at once (e.g. all data blocks must be displayed). The user may also specify display characteristics for individual flight sets or individual flights.

ETMS estimates flight positions used by the TSD because the traffic situation data updates (TZs, and TOs) received from the NAS are not synchronized. Although ETMS receives an update of the traffic situation data for each flight typically every minute, these updates are not all received at the same time. Therefore, to provide a more consistent display, ETMS estimates the positions for all the flights at the same instant in time when it generates the display update.

ETMS estimates flight positions in a straightforward manner. The time over which the flight must be extrapolated is the time of the update minus the time of the last position report. The difference (or delta time) is used with the last reported speed and heading to compute the deltas in latitude and longitude. The deltas are applied to the last reported latitude and longitude to produce the estimated position.

A danger in extrapolating aircraft positions is that if ETMS were to stop receiving position updates for a flight, the flight would appear to continue to move with each TSD update. Because the estimated position for that flight would not have the same accuracy as positions estimated for flights with position updates, ETMS checks the last position update time when generating the update file. If a position update is not received for more than seven minutes, a flag is set in the update file indicating that the flight is *ghosting.* The TSD draws ghost aircraft on the display in outline form, rather than as a solid aircraft. The traffic manager can visually distinguish the more accurate positions from those that might be less accurate.

When the user selects a flight subset (e.g., only flights arriving at ORD) for display, the TSD scans the flight data in the traffic situation update to determine which flights meet the selection criteria. Included in the selection criteria are some flight data that can be displayed (aircraft type, origin, destination, and altitude) and some data that cannot be displayed (e.g., sectors, fixes, ARTCCs, or airways traversed). ETMS includes these non-displayable data items in the traffic situation update data to permit filtering.

The TSD displays old data by using ETMS traffic situation updates that are stored on the file server. The TSD retrieves updates specified by the traffic manager and replays them at a rate specified by the traffic manager. The display of old flight data looks exactly like live flight data and can be controlled the same ways as live data. Weather and Monitor Alert data can be replayed with the traffic data. Using a VCR-like control panel, the traffic manager can pause, resume, single step forward or backward, or replay forward or backward as desired.

6.1.23.2.3 Alerts

The TSD displays alerts graphically on the screen with geographical, weather, reroute, FEA/FCA, and traffic situation data as directed by the manager, who can turn the alert display on or off using a menu option or keyboard command. Once the alert display is turned on, the TSD automatically refreshes the display every minute with the latest alerts until the manager turns it off. Dialog box entries and semicolon commands allow the manager to control what alerts are displayed and request other Monitor Alert data.

The TSD draws alerts on the display as icons. The shape of the icon indicates the alert type: circles for airports, triangles for fixes, and hatching within sector boundaries for sectors. The color of the alert icon indicates the alert status. The direction of the hatching of sectors indicates the altitude level at which a sector is alerted. A short line(s) extending to the left from the triangle indicates the altitude level(s) at which a fix is alerted. A line at the bottom of the triangle indicates that the low level fix is alerted. A line from the middle of the triangle indicates that the high level fix is alerted. A line from the top of the triangle indicates that the super-high level fix is alerted. If the projected active traffic demand exceeds the alert threshold, the TSD displays new alerts in red. If the proposed and/or scheduled demands exceed the threshold, the TSD draws a yellow alert icon.

The alert icons that are drawn on the display represent the highest alert level for the element during the time period (time limit) specified by the user. The time limit may be specified in quarter-hour increments from 0.25 to 2.25 hours.

The TSD provides alert data beyond icons. The manager can examine which 15-minute intervals are alerted using a *time line* display, a *bar chart* of projected traffic demands and alert thresholds, a *flight list* report of traffic at the alerted element, and current *flight positions* that compose the traffic for a specified interval. The TSD draws the flight positions directly on the map overlay. The time line, bar chart, and reports are displayed in separate windows. The TSD also allows the manager to examine the same information for non-alerted elements, which appear in magenta on the display.

Authorized managers can turn specific intervals of the time line green, indicating that they are resolving the alert. Intervals that have been turned to green also have a red or yellow horizontal stripe, which indicates that they had been alerted. If all intervals on the time line are green, the alert icon on the TSD also turns green. The user who turns an interval green will see the effects immediately while users at the other sites will see the effects after the next Monitor Alert update.

Generally, the TSD gets the data for time line and bar chart displays from the alerts update received from the Hubsite once every minute. This update contains the data for all alerted elements and for specified airports and sectors whether they are alerted or not. However, if the alert update does not contain the data for the examined element or if the time range of the time line is greater than 2.25 hours, the TSD requests the data from the *Traffic Demand Database (TDB)* at the Hubsite.

The TSD gets the data for the list report and flight positions from the traffic demand and flight databases. Because ETMS generates the alert updates every minute, while it updates the traffic demand and flight databases continuously, it is possible to see inconsistencies between the time line/bar chart and the report/flight positions. It is also possible to see inconsistencies between a report and the flight positions because ETMS may perform a database update between the times these displays are generated.

Also see the description of Monitor Alert in Section 6.1.15.

6.1.23.2.4 Weather Data

The TSD displays weather graphically on the screen with geographical, traffic situation, reroute, FEA/FCA, and alert data as directed by the manager, who can turn the weather display on and off using a menu option, keyboard commands, or a semicolon command. The manager can use a dialog box, keyboard commands, or semicolon commands to control which types of weather data are shown. Once the weather is turned on, the TSD automatically refreshes the display when a new data update is received until the manager turns it off.

The TSD displays radar-determined precipitation data (NOWRAD) using a six level color-coded solid overlay, drawn below the other map elements so that they are still visible. The manager can control which precipitation levels are displayed by specifying the lowest level that is to be drawn. NOWRAD data is available in two resolutions for three geographical areas (CONUS, Canada, and Puerto Rico). The highest resolution is the NOWRAD2 data that is drawn using 2 km square blocks. NOWRAD2 data is normally available at all ETMS sites. The NOWRAD data is also available in a lower resolution that is drawn using 8 km square blocks. However, this data is only distributed to ETMS sites if the higher resolution data becomes unavailable.

The TSD can draw other weather overlays, including Jet Stream, Radar Tops, Lightning, and CCFP. The TSD displays jet stream winds of 70 knots or greater using an overlay that shows the direction, speed, and altitude of these winds. The jet stream is shown using streamlines that are drawn using solid lines in a color specified by the manager. The arrows on the streamlines indicate the direction of the jet stream.

The TSD displays the location of lightning strikes by drawing cross hairs at these locations. The manager may specify the color of these cross hairs. The TSD can also display historical lightning data using different colors for each data update time. The TSD displays a Radar Tops overlay that shows the altitude of the cloud tops in precipitation areas. The TSD displays the CCFP data using a color-coded solid overlay that is drawn below all other map elements so that

they are visible. The manager can control which forecast product is to be displayed by selecting between the 2-hour, 4-hour, and 6-hour products.

ETMS produces weather and Runway Visual Range (RVR) reports when requested by the manager through the TSD using a menu entry or semicolon command. When the METAR and TAF reports are received, they are combined into a single report that is displayed in a separate window on top of the TSD display. RVR reports are also displayed in a separate window on the TSD display.

ETMS maintains a full set of the METAR/TAF data in the encoded form as provided by Weather Services International (WSI). When a manager requests the weather reports for a particular airport, ETMS retrieves the latest terminal forecast and surface observations received for that airport and formats a report using standard weather terminology.

6.1.23.2.5 Reroute Data

The TSD provides traffic managers with the ability to define and display reroutes for avoiding severe weather conditions. These reroutes are stored in a distributed database so that they may be shared with other ETMS users. There are three types of reroutes: public, local, and private. Severe weather specialists at the ATCSCC typically create public reroutes that are shared with all ETMS users. Users at ETMS field sites may create local reroutes and share them with other ETMS users within their facility. Any user may create private reroutes for viewing on their workstation. When the traffic manager turns on the display of reroutes, the TSD display refreshes automatically to show the latest reroutes and new updates as they are received.

The TSD provides traffic managers with the ability to query a database of Playbook reroutes. The traffic manager can thus tailor the Playbook reroute as desired to define the rerouting necessary to avoid severe weather.

The TSD also provides traffic managers with the ability to query a database of Coded Departure Routes (CDR) that can be used to define reroutes. Coded Departure Routes are standard routes to be used for flights between designated origin and destination airports. The CDR database is maintained at the Hubsite and is updated every 56 days.

6.1.23.2.6 Flight Evaluation Areas/Flight Constrained Areas (FEAs/FCAs)

The TSD provides traffic managers with the ability to define and display Flow Evaluation Areas (FEAs) and Flow Constrained Areas (FCAs). An FEA/FCA is a user-defined volume of airspace along with an associated flight filter. FEA/FCAs are used to show areas where the traffic flow should be evaluated or where flight rerouting has been suggested due to severe weather conditions. The traffic manager defines the geographic area of an FEA/FCA by drawing a polygon on the TSD display and defining the ceiling and floor of the FEA/FCA by using a dialog box. Alternatively, the traffic manager can designate a NAS element as an FEA/FCA. The traffic manager can also define the criteria for filtering the flights that are predicted to intersect the FEA/FCA. The traffic manager also defines the time period for the FEA/FCA, which must end within the next 15 hours.

These FEA/FCAs are stored in a distributed database so that they may be shared with other ETMS users. There are three types of FEA/FCAs: public, shared, and private. Severe weather specialists at the ATCSCC typically create public FCAs that are shared with all ETMS users. Users at ETMS field sites may create shared FEAs and share them with other ETMS users within their facility and other designated ETMS facilities. Shared FEAs are always shared with the ATCSCC. Any user may create private FEAs for viewing on their workstation. When the traffic manager turns on the display of FEA/FCAs, the TSD display refreshes automatically to show the latest FEA/FCAs and new updates as they are received.

The traffic manager can examine an FEA/FCA to determine the flights that are predicted to intersect the FEA/FCA. When an FEA/FCA is examined, the TSD displays a time line for the FEA/FCA that shows either the peak 1-minute occupancy count or the total occupancy count for each 15-minute interval from the FEA/FCA start time to its end time. The traffic manager can request a display of a bar chart that shows the breakdown of these counts between active and proposed flights for each 15-minute interval. The traffic manager can also request FEA/FCA reports that list the flights that are predicted to intersect the FEA/FCA in each 15-minute interval and display the current flight positions for those flights.

Also see the description of FEAs/FCAs in Section 6.2.4.

6.1.23.2.7 Text Reports

ETMS produces request reports when requested by a traffic manager through the TSD or the TM Shell (see Section 6.1.22 Traffic Management Shell (TMShell)). Using the TSD, the traffic manager enters a request by the semicolon method. After making a request, the traffic manager continues to perform other TSD functions. When ETMS is finished generating the report, the TSD notifies the traffic manager by displaying a Report Notification dialog box. The traffic manager views the report in a separate window that appears on top of the TSD display. The TSD continues to show the map overlay, updates the display of traffic situation data, and interacts with the traffic manager in the original window.

The traffic manager can request reports containing flight data for a specified airport, fix, sector, FEA/FCA, or ARTCC. The ETMS processing of a report request consists of two steps: retrieving the data and generating the report. When requested data for an airport, fix, sector, or ARTCC falls within the previous 12 hours or next 15 hours, ETMS retrieves the requested data from the live traffic demand and flight databases. Therefore, within the current 27-hour window, the traffic manager can see up-to-date flight data derived from airline schedules, NAS messages, EDCT messages, flight modeling, and the traffic demand processing. However, because the reports are derived from the Traffic Demand Database (TDB), the traffic manager can see reports only for those airports, sectors, and fixes that are monitored. The monitored elements are specified in a manually maintained list; however, elements can be added to or deleted from the list according to direction from Traffic Management.

Reports for arrival and departure fixes are processed differently than other reports because the arrival and departure fixes are not monitored elements in the traffic database. ETMS generates data for an arrival or departure fix by first retrieving the flights that are arriving at or departing from the airport associated with the specified fix. Then ETMS examines each flight to determine

which arrival or departure fix it uses. Only those flights that use the requested arrival or departure fix are used to generate the requested report.

Reports for FEA/FCAs are processed differently than reports for NAS elements because Flow Evaluation Areas and Flow Constrained Areas are not monitored elements in the Traffic Demand Database. When a report for an FEA/FCA is requested, ETMS determines the flights that are predicted to intersect the FEA/FCA during the specified time period using the current data that is contained in the live flight database. The data for those flights are used to generate the requested report.

When the requested data is outside the current 27-hour window, ETMS retrieves the data from the airline schedule database; therefore, the traffic manager can see only the static values contained there. Because the airline schedules do not contain the flight details (e.g., sector boundary and fix crossing times) that the live flight database contains, the traffic manager cannot obtain sector and fix reports for flights outside the current 27-hour window.

Once the flight data is retrieved, ETMS formats, sorts, and counts the data as requested by the traffic manager. The following types of reports may be requested via the TSD command line:

- Sector counts (AREA) – Lists flights traversing a specified sector or multiple sectors. The traffic manager can specify a time period, time intervals, and count options for the report.
- Arrival delay prediction (ARRD) - Predicts arrival delays for specified airports.
- Flight counts (COUNT) - Lists flight counts for flights departing from, arriving at, or traversing an airport, fix, sector, or ARTCC. The traffic manager can specify the criteria for counting the flights (e.g., count by airline).
- FCA reports (FCATA) – Provides Count and List reports for FCAs.
- Fix loading (FIXL) - Lists flight counts for flights traversing a specified arrival or departure fix or all arrival or departure fixes for a specified airport.
- List flight plan (LIFP) - Lists flight plans for specified flights.
- Flight list (LIST) - Lists flight info for an airport, fix, sector, or ARTCC. The traffic manager can specify the data items to be shown in the report and how to sort the report.
- Flight list original (LISTO) - The traffic manager can view a list of flights and associated information as in a flight list (LIST), except that original times are displayed instead of controlled times for controlled flights that have not departed.
- Verify time (VT) - Compares actual arrival/departure times with a specified time type (e.g., controlled time). The traffic manager can specify the flights, time type, and report format.

6.1.23.3 Interfaces

TSD is an internal ETMS function that interfaces only with other ETMS functions that provide the geographic, traffic, alert, weather, reroute, and FEA/FCA data in needs. Refer to Section 4, TFM Interfaces for a discussion of the ETMS external interfaces.

6.1.23.4 Data Sources

Data inputs to the TSD are as follows:

- Geographical Map Overlays – available as static data on the TSD workstation; the Auxiliary Support Functions at the ETMS Hubsite send geographical data and aircraft data to the TSD workstation
- Traffic Situation Data – available from a local ETMS file server and provided automatically by the ETMS Data and Communications Server (DACS) residing on the TSD workstation
- Monitor Alert Data – available from a local ETMS file server and provided automatically by the DACS residing on the TSD workstation
- Request Reports – received upon request from the ETMS Hubsite via the ETMS List Server
- Weather Data – METARs, TAFs, and RVRs received upon request from the ETMS Hubsite; all other weather data available from a local ETMS file server and provided automatically by the DACS residing on the TSD workstation
- Reroute Data – available from a local ETMS file server and provided by the RRSVR process on the local file server
- FEA/FCA Data – available from a local ETMS file server and provided by the RRSVR process on the local file server
- Playbook and CDR Data - available from the Oracle Reroute database at the Command Center and retrieved upon request via the ETMS Routing Database Proxy Server (RDPS); RDPS retrieves data from the Oracle Reroute database server using the ETMS *External Communications Functions.*

The DACS process on the TSD workstation receives flight information from the local FTM process, weather data from the local Weather Server, alert data from the local Alert Server process, and playbook category data from the local Routing Database Proxy Server.

6.1.23.5 Outputs

The TSD displays data in graphics drawn on a map, text reports, and alert and FCA time lines and bar charts. The following outputs are provided through the TSD user interface:

- Maps Database
- Traffic Situation Data

- Monitor Alert Displays
- Request Reports
- Weather Displays
- Reroute Displays
- FCA Displays

The traffic manager can update data through the TSD. The TSD sends the following data to the indicated ETMS functions at the Hubsite:

- Capacity, GA estimate, and alert status updates to the Traffic Model functions
- Schedule database updates to the SDB Functions
- Reroute and FEA/FCA flight data transactions to the RRSVR process.

For each update, the TSD receives a reply from the selected function either acknowledging the update or indicating an error in the update. The TSD sends the updates and receives the replies through the ETMS Communications Functions.

6.1.23.6 Reference Sources

- *Enhanced Traffic Management System (ETMS) Functional Description, Version 7.4, Report No. VNTSC-DTS56-TMS-002*, dated June, 2002 (Draft); Volpe National Transportation Systems Center, U.S. Department of Transportation, Cambridge, MA
- *Enhanced Traffic Management System (ETMS) Reference Manual, Version 7.4*, Report No. VNTSC-DTS56-TMS-004, dated May 2002; Volpe National Transportation Systems Center, U.S. Department of Transportation, Cambridge, MA

6.1.23.7 Miscellaneous

Version No: ETMS 7.5

Development Languages: C, C++

Platform: HP-UX 11.0, Red Hat Linux 7.3

COTS Products Used: None

Software Maintenance Organization: Volpe

6.1.24 Volpe CDM DataGate Intranet Website

6.1.24.1 Overview

The Volpe CDM DataGate Intranet Website provides information for use by CDM participants, FAA QA, and User Support staff. Information provided on this site includes data quality metrics data as well system and weather status. This site is not intended for use by the field sites, as the field sites use the ATCSCC Intranet website (Section 6.1.1).

CDM data quality is tracked and reported for each CDM participant airline on this website. Airlines have access on the website to detailed flight data for their own flights and those of their sub-carriers. Airlines can see only summary data (averages, trends) for any airline other than their own.

Access to the site requires a direct request to Volpe Center for a user ID and password.

For further information on CDM data quality analysis functions performed by Volpe using data monitored and collected through the Volpe CDM DataGate Intranet site, see Section 5.3.4 Analyze TM Initiative Effectiveness.

6.1.24.2 Functions

The Volpe CDM DataGate Intranet website provides the following menu options:

- Weather - Weather information mostly used by CDM participants
    - CCFP (Collaborative Convective Forecast Product)
    - CIP (Current Icing Potential)
    - ITWS (Integrated Terminal Weather System)
    - NCWF (National Convective Weather Forecast)
    - RVR (Runway Visual Range)
- SMA - SMA information is mostly used by Volpe User-Support staff. SMA Status with following information -
    - Centers
    - ARTS Server Up / down status and time
    - Number of Outages
    - Downtime
    - Total I / O counts
    - Volpe Server Up / Down status and time
- Status Information - Status information mostly used by Volpe User Support staff.
    - CDM Message Counts by airlines

- ADL Status – ADL Client List by airlines and FAA clients, ADL Status and Matrix
- RVR Monitor – Airport RVR status

- Documentation – Explanation about the Message Count Graph and the ADL Status web pages
- Data Quality – Data Quality information mostly used by the airlines, QA and Volpe Testing Staff. Access to Data Quality Database with information on –
  - Data Quality Metrics –Display CDM Data Quality performance metrics
  - Time-Out Analysis – Analysis of Time Out Cancellations that are based only on OAG data, or that occur during a GDP
  - Flight History – Display detailed history of OAG, CDM, and NAS messages received for a specified flight.
- Change Password – change user password
- CDM Photos - Meeting pictures.

6.1.24.3 Data Sources

- The Weather Information comes from various sources:
  - RVR information comes from link to the ATCSCC RVR site.
  - CCFP information comes from link to the AWC site.
  - ITWS information comes from link to Lincoln Labs facility (new racks are being installed at Volpe for ITWS operations to begin in the fall of 2002)
  - CIP – from a link to the CIP website
- Other data such as status information are entered manually at Volpe.

6.1.24.4 Outputs

The types of metrics displays available on the website are:

- Comparative Bar chart - value of metric for specified interval by airline and average value of metric for specified interval, averaged across all airlines.
- Trend Chart – weekly value of metric over the last 4 months.

- List of Flights – list of flights for specified airline that meet the metric's criteria during a specified interval.
- Flight History – message history for specified flight selected from List of Flights.

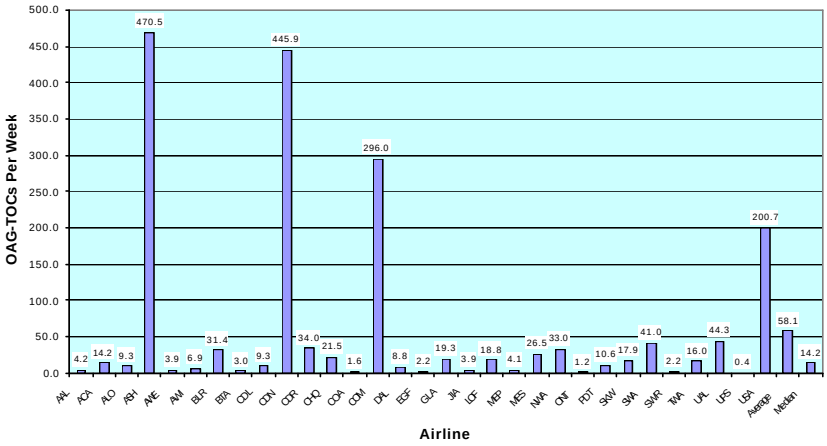


Exhibit 6-70. Comparative Bar Chart

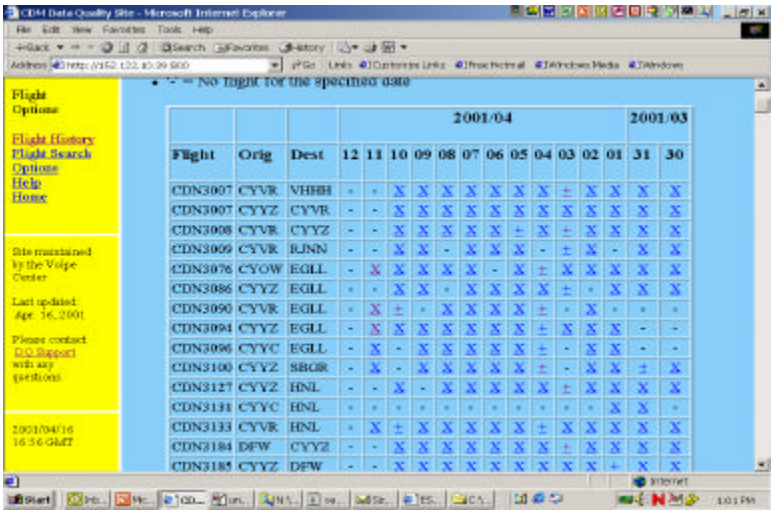


Exhibit 6-71. List of Flights

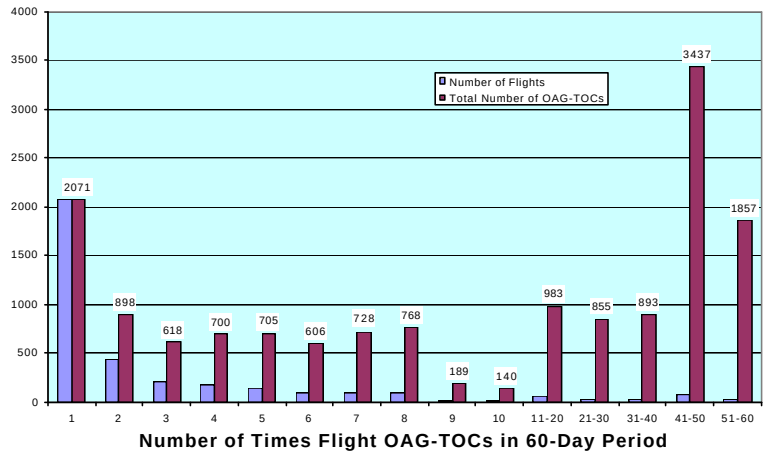


Exhibit 6-72. Trend Chart

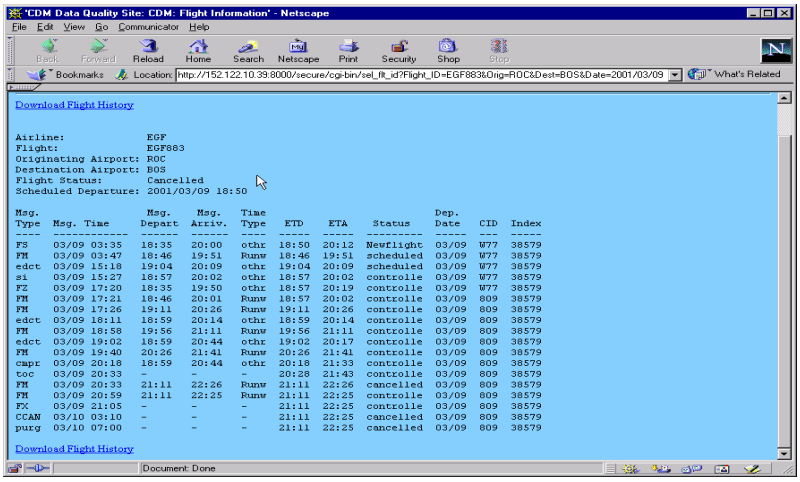


Exhibit 6-73. Flight History

6.1.24.5 Reference Sources

N / A

6.1.24.6 Miscellaneous

Version No: N / A

Development Languages: Perl, C GUI Script, Java Script

Platform: APACHE Web Server

COTS Products Used: Information not readily available.

Software Maintenance Organization: Volpe

6.1.25 Web-Based Situation Display (WSD)

6.1.25.1 Overview

The Web-based Situation Display (WSD) is a low-cost approach for expanding access to ETMS beyond the limited number of FAA facilities in which it resides. The WSD provides TSD-like displays and functions via a PC and a standard web browser by accessing a web server located at the ATCSCC. Because WSD does not require ETMS hardware, it is used in situations where it is not practical or cost effective to install ETMS (e.g., in TRACONs and Towers). The data displayed on the WSD is exactly the same data that is viewed by traffic managers that use ETMS. It is provided via an interface between the WSD web server and ETMS. Access to the WSD is restricted to the FAA and other authorized government agencies (e.g., the military). FAA users access the WSD web site through the ATCSCC Intranet. All other users access the WSD web site via the Internet with access granted to authorized users with the correct password and RSA SecurID token.

Traffic managers in non-ETMS facilities use the WSD as a decision support tool for monitoring and adjusting the flow of air traffic in the National Airspace System (NAS). Like the TSD, the WSD displays ETMS data in a variety of ways including graphical displays superimposed on map overlays, textual reports of flight and traffic activity, and bar graphs of traffic demand counts.

The traffic manager can use the WSD graphic display to show air traffic data processed by the ETMS databases and to show many types of information related to air traffic patterns. The display consists of a background map showing geographic or sector boundaries, airports, navigational aids (NAVAIDs), airways, and other elements in whatever combination the traffic manager specifies. It shows icons representing all the aircraft in the area being displayed and, optionally, three types of weather (i.e., NOWRAD, CCFP, and lightning). The most recent data is shown on the WSD every time its screen refreshes, which is once a minute. In addition to viewing traffic displays, lists, and reports, the WSD enables the traffic manager to update capacities, schedule information, and GA estimates. The WSD web server sends these updates to the central processes at the Volpe Center, where the data is processed.

6.1.25.2 Functions

Traffic management specialists use the WSD to view air traffic in a variety of modes. For example, nationwide, regional, or local airport traffic can be viewed, and weather features affecting the traffic can be displayed. The WSD provides the same information as the TSD and, although it provides the core TSD features needed to manage air traffic within the conditions and constraints of the NAS environment, it does not yet provide all TSD features. Additional features will be added in later WSD builds. The list below summarizes the types of information WSD provides. It also lists the differences between WSD 2.6 and TSD. Refer to Section 6.1.23 TSD for a summary of each list item.

- Geographical data, including map overlays of airports, NAVAIDs, fixes, airways, latitude and longitude grid, ARTCCs, sectors, TRACONs, and Special Use Areas.

WSD 2.6 does not provide the following TSD map commands: Runway Layout, Distance Measurement Estimation (DME), Projection

- Flight data – WSD 2.6 does not provide the following TSD flight commands: Show / Hide Flights (flights icons are always shown for the selected flight criteria), Show / Hide Flight Counts (flight count windows are not displayed), Customize
- Alerts – WSD 2.6 does not provide the following TSD alert commands: Show / Hide Alerts (alerts are always displayed for selected elements), Default Time Range (the alert time range is always 2.25 hours), Alarms (no audible or flashing alarms are provided for alerted elements), Turn Green
- Weather data – WSD 2.6 does not provide the following TSD weather commands: Show / Hide Weather (selected weather types are always displayed), WX Report, and RVR Report. Additionally cloud tops and jet stream data is unavailable for display.
- Reroutes – WSD 2.6 does not provide the following TSD reroute commands: Show / Hide Reroutes (selected reroutes are always displayed), Create Reroute
- FEAs / FCAs –WSD 2.6 does not provide any TSD FEA commands nor does it provide the following TSD FCA commands: Show / Hide FCA (selected FCAs are always displayed), Create FCA
- List Reports.

6.1.25.3 Interfaces

The WSD provides a web-based GUI for user interaction. The WSD interfaces are the same as the TSD interfaces. Refer to Section 6.1.23, TSD, for a summary of the interfaces.

6.1.25.4 Data Sources

The WSD data sources are the same as the TSD data sources with the exception of weather data. WSD does not list or display METARs, TAF, jet stream, or cloud tops. Refer to Section 6.1.23 TSD for a summary of the data sources.

6.1.25.5 Outputs

The WSD outputs are the same as the TSD outputs. Refer to Section 6.1.23, TSD, for a summary of the outputs.

6.1.25.6 Reference Sources

- *Enhanced Traffic Management System (ETMS) Functional Description, Version 7.4, Report No. VNTSC-DTS56-TMS-002*, dated June, 2002 (Draft); Volpe National Transportation Systems Center, U.S. Department of Transportation, Cambridge, MA
- *Enhanced Traffic Management System (ETMS) Reference Manual, Version 7.4*, Report No. VNTSC-DTS56-TMS-004, dated May 2002; Volpe National Transportation Systems Center, U.S. Department of Transportation, Cambridge, MA

- TFM Infrastructure and Operational Products web page, *http://www.faa.gov/aua/aua700/products/products.shtml*
- Web-Based Situation Display Fact Sheet, *http://www.faa.gov/aua/aua700/tools/marketing/webdisplay.ppt*

6.1.25.7 Miscellaneous

Version No: WSD 2.6

Development Languages: HTML, Perl, CGI script, Java script

Platform: Windows 9x / NT / 2K

COTS Products Used: Information not readily available

Software Maintenance Organization: Volpe

6.2 TFM Products

The following are products from TFM operational tools.

6.2.1 Airport Demand Chart (ADC)/Airport Arrival Demand Chart (AADC)

6.2.1.1 Overview

The Airport Demand Chart (ADC) is a web-based, graphical display of airport arrival information. It is a single web page, written in Java, which displays FSM data by accessing the FSM server at the Command Center. Currently, the ADC is being used by ATCSCC specialists and by several CDM airline participants to continuously monitor airports. It is available on the ATCSCC Intranet and ATCSCC public website (www.fly.faa.gov) by the name of its previous version, Airport Arrival Demand Chart (AADC). The functionality is the same through both access points (display only) with the exception that, via the Intranet site, it does not appear to be viewable using the Internet Explorer 6 browser at the current time (Netscape only). Since the ADC web page is labeled *Airport Arrival Demand Chart*, the two terms, ADC and AADC, are often used interchangeably.

The ADC, whose output is in the same format as the FSM demand/capacity graphs, allows the user to view multiple airports on one screen. When users select the desired airport and the time increment in which to view demand (15-minute, 30-minute or 60-minute increments), colored bars appear on the graph to illustrate current demand on the airport. The colors correspond to the type of filter(s) the user has selected for viewing. The user can view the data to immediately detect any demand/capacity imbalance and possibly take action on flights.

ADC has two software components. One is the ADC Server residing on the machine running the web server. Another is the ADC Client, which is a Java Applet downloaded to and running on the users' web browsers.

6.2.1.2 Functions

6.2.1.2.1 User Functions

The ADC allows users to see the latest arrival demand metrics for selected airports. Demand for multiple airports can be viewed simultaneously. See Exhibit 6-74. Airport Demand Chart (ATCSCC Public Website).

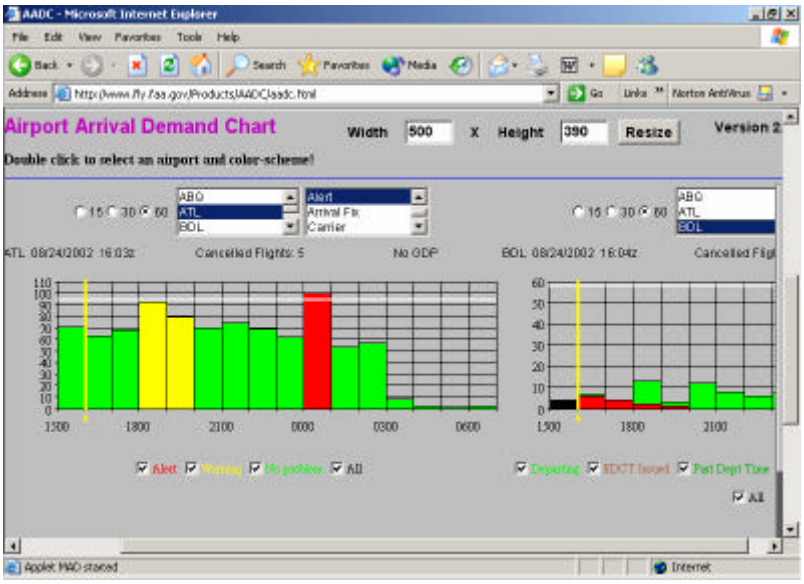


Exhibit 6-74. Airport Demand Chart (ATCSCC Public Website)

User functions include:

- Select chart display dimensions (width and height).
- Select Airport for which to view Demand / Capacity from a drop down list.
- Select segment time frame (15, 30 or 60 minute timeslots for capacity display).
- Select how to view the arrivals from a drop down list (i.e., by arrival status, alert status, arrival fix, carrier, or center).
- Select one or more filters for viewing arrival demand based upon the selected viewing option selected (see table below). The colors on the output graph correspond to the selected filters.

Exhibit 6-75. Filters Associated with ADC Viewing Options

Options for Displaying Airport Arrivals	Filters
Arrival Status	Departing, EDCT Issued, Past Departure Time, Arrived, Flight Active, Irregular
Alert Status	Alert, Warning, No Problem
Arrival Fix	One filter for each airport arrival fix
Carrier	One filter for each CDM airline
Center	One filter for each ARTCC

6.2.1.2.2 Software Functions

The ADC Server is separated into three distinct parts: Airport Monitors (A1, A2, …, A*n*), Client Monitors (C1, C2, …, C*m*), and an Internal Controller. To improve efficiency, each of these parts is run in a separate thread.

The ADC Server creates one Airport Monitor thread for each airport being monitored by a client. Only one instance of the Airport Monitor is invoked for a specific airport even if more than one client is monitoring that airport. Each instance of the Airport Monitor connects to a data server that supplies aggregate arrival and departure flight counts for the specified airport. The flight counts contain counts for each color scheme available in ADC. If an ADC client requests a flight list and is authorized to do so, the Airport Monitor sends a request for the specific list to the data server and returns the response to the client.

The ADC Server creates one Client Monitor thread for each ADC Client that requests a connection. The Client Monitor responds to requests for monitoring one or more airports by informing the Internal Controller, receives new airport data from the Internal Controller and passes it on to its client. The messaging server is the same as the one in use by the Route Management Tool, which allows RMT and ADC data to be shared by any client.

The Internal ADC Controller is responsible for creating and destroying instances of the Airport Monitor and Client Monitor and routing data between them. It registers as an exported service with the CDR Service Manager, which routes new ADC Client connections to the ADC Server. When the FSM Manager sends a new ADL to an Airport Monitor, the Internal ADC Controller receives the reformatted data from the Airport Monitor and passes it on to every interested Client Monitor.

The ADC Client is written as a Java applet and first makes a connection back to the web server in order to connect to the ADC Server. Communication between the ADC Client and the ADC Server follows the same protocol in use by the CDR project.

6.2.1.3 Interfaces

The ADC Server connects directly to the FSM Manager, and behaves like an FSM Client. The ADC Client uses Socket, TCP/IP, as the main method for communication between ADC Clients and Server. The ADC software architecture is shown in Exhibit 6-76. ADC Software Architecture.

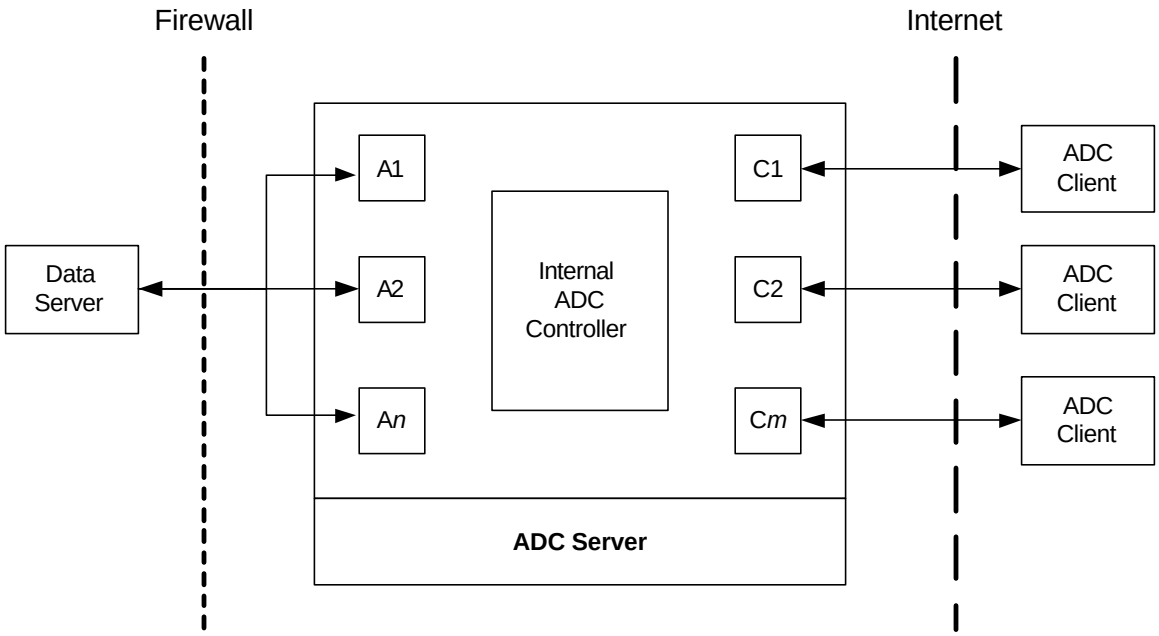


Exhibit 6-76. ADC Software Architecture

6.2.1.4 Data Sources

The ADC server connects directly with the FSM Manager through a firewall to provide all data for ADC clients.

6.2.1.5 Outputs

Users are able to view current airport demand and capacity metrics for multiple selected airports in graphical form as previously described.

From a software standpoint, the two output message types are a DATA_REQUEST message and an ADC_DATA message.

The DATA_REQUEST message contains the name of the airport and flags indicating whether arrivals, departures, both, or neither is to be monitored. The ADC Client is able to monitor any airport contained in the FSM Controller's airport configuration file.

The ADC_DATA message contain the name of the airport, the aggregate data used to display the bar graph, and if authorized, a list of flights.

6.2.1.6 Reference Sources

- ADC Software Architecture memorandum, dated 04/26/00
- ADC Client Software Design Document, dated 05/26/00
- Airport Demand Chart Fact Sheet Web Page - http://www1.faa.gov/aua/aua700/tools/marketing/asdifact.ppt
- ATCSCC Intranet and Internet websites

6.2.1.7 Miscellaneous

Version No: Public website AADC, V2.1 as of November 8, 2002

Development Languages: Java 1.1 (ADC Server)

Platform: Information not readily available

COTS Products Used: Information not readily available

Software Maintenance Organization: Metron Aviation

6.2.2 Aggregate Demand List (ADL)

6.2.2.1 Overview

The Aggregate Demand Lists (ADL) file is the data source for FSM.

The FAA issues Ground Delay Programs (GDPs) to prevent aircraft from arriving at an airport at a rate well above the rate that the airport can accept. FSM is used by the ATCSCC to plan, implement, and manage GDPs and Ground Stops (GSs). ETMS generates ADLs that are used to update all the FSM tool displays. ADLs are the data structures from which FSM displays user-requested data.

6.2.2.2 Functions

The functions of three main processes involved in ADL processing are described below: the ETMS ADL Distributor, FSM ETMS Manager, and FSM Manager. The latter two are a part of FSM and the first one is on the ETMS side. In addition, ETMS processes the data internally, as shown below in Exhibit 6-77. FSM Client Server Architecture. On the FSM side, the FSM Client is responsible for displaying the data.

ETMS ADL Distributor (at Volpe) processing and management functions are as follows:

- Maintains a master list of the monitored airports and which users are viewing which airports.
- Every 5 minutes extracts data from its database to match the master list of monitored airports.
- Generates ADL files for the monitored airports by a given FSM server. (May send an additional ADL update if a GDP is issued between regular updates.)
- Adds additional data to the ADL file (such as the header section) specifically to support FSM.
- Filters the flight data depending on the user. There are three categories of users with respect to filtering: (1) Unfiltered, (2) Airline, and (3) GA and Military. ETMS filters the flight data in the ADL in a manner that allows the FSM algorithms to work in the same manner as for a non-filtered ADL, but prevents users from discerning the identity of filtered flights. This is accomplished by overwriting the data in the following four fields: Flight ID, aircraft type, departure/arrival airport, and major carrier.
- Encrypts and compresses ADL files.
- Pushes the ADLs to the appropriate FSM site using the socket connection set up by the FSM ETMS Manager.

In addition, ETMS:

- Receives GDPs, and processes the slot lists when the GDPs are issued, compressed, revised, and extended so that the Aggregate Demand Lists always reflect the latest controls.
- Determines the validity of the airline substitution messages, and if accepted, and updates the ADLs to reflect these changes.
- Distributes the parameter data so that all users are sharing a common picture.
- Compares the records in the ADL to flights it has in memory. Any records that have changed or been added are written to a change or delta file, which is also written to the ADL reports directory.

FSM ETMS Manager (on the local FSM server) ADL processing and management functions are as follows:

- Sets up socket connections for communications with the ETMS ADL Distributor.
- Registers the FSM site and airports being monitored with the ETMS ADL Distributor.
- Starts the Heartbeat Timer, once a connection has been established with the ETMS ADL Distributor process. When the Heartbeat Timer expires, the ETMS Manager checks to see if the Heartbeat Acknowledgment or anything else has come through the communication pipe since the last time the timer expired.
- Decompresses and decrypts the raw ADLs.
- Generates a 'delta' file and writes the ASCII ADL text files to the ADL reports directory.
- Notifies the FSM Manager (running on the same server) of the arrival of the new ADL file.
- Compares the list of flights in the new ADL with the flights from the previous update.
- Writes changed flight data (departure times, flight status, etc.) to an FSM historical data file (maintained by the HIST manager process) for the particular airport and current day (historical data files contain data for 24 hours from 0800Z on the file date until 0759Z on the following day).
- When historical data is requested, opens and reads the appropriate historical file.

FSM Manager (on the local FSM Server) ADL processing and management functions are as follows:

- Maintains a list of airports monitored by the various the FSM Clients in its domain.
- Reads ADL files and delta files received from the FSM ETMS Manager.

- Sends ADL: information to any of its FSM clients monitoring the particular airport associated with the ADL in live data mode (i.e., real time).

FSM Client ADL-related functions are:

- Accepts user configuration requests to monitor one or more airports.
- Specifies (to the FSM Manager) a request to receive ADL data for the user specified airports.
- On receipt of a whole ADL file, the client discards its previous update, and displays the current update in the screen.
- On receipt of a partial ADL (update only), the client updates its data and updates the screen.

6.2.2.3 Interfaces

There are currently three main processes all running on the same machine as the FSM Server: the ETMS Manager, the FSM Manager, and the HIST Manager. ADL data passes to and from these three as needed for supplying data for their particular functions (as described above).

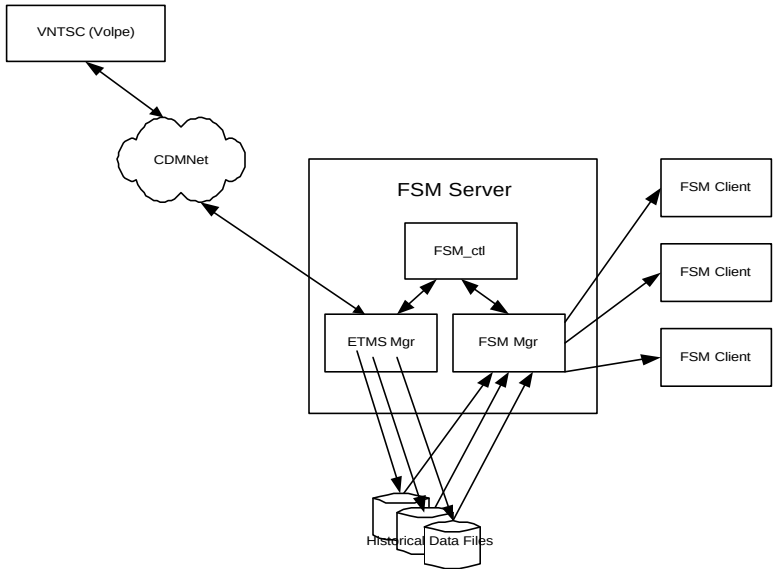


Exhibit 6-77. FSM Client Server Architecture

ETMS generates the ADLs that are used to update all the FSM displays. Exhibit 6-78. ETMS Traffic Management Function ADL Processing depicts the ADL generation process within the ETMS Traffic Management Function.

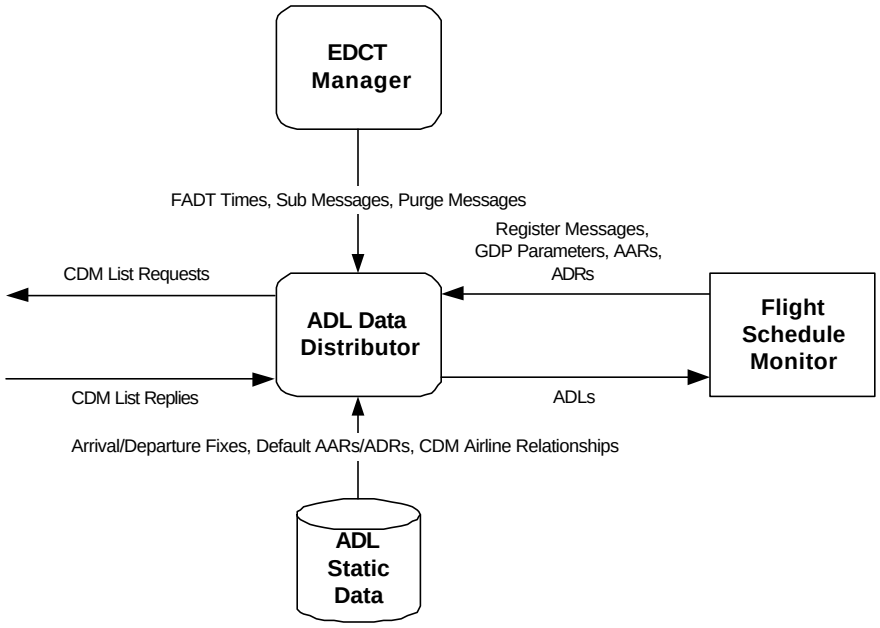


Exhibit 6-78. ETMS Traffic Management Function ADL Processing

6.2.2.4 Data Sources

FSM receives ADL files from ETMS (at Volpe) for each airport registered in the server. The FSM ETMS Manager reads these files and generates a historical data file for each airport being monitored.

The ADL contains 53 data fields, primarily composed of data extracted from the ETMS hub site databases, which are maintained with a combination of OAG data (published schedules), airline-provided flight data messages (FC, FX, FM, SI and OOOI data), NAS messages generated from the Host system (see list below) and issued ground delays (EDCTs: CT -for individual flight estimated departure control times and FA – for blanket delays). The ADL also includes GDP-specific data entered by the traffic management specialist using FSM.

NAS messages contain information for en route flights flying under Instrument Flight Rules (IFR) and provide flight plan data and real-time data describing arrivals, departures, flight plans, amendments, cancellations, center boundary crossings, and position updates. The Host sends ETMS flight plan data, used for ADLS, via the following messages:

- Flow Control Flight Plan Information (FZ)
- Flow Control Departure Information (DZ)
- Flow Control Cancellation (RZ)
- Flow Control Arrival Information (AZ)
- Flow Control Amendment Information (AF)

- Flow Control Update Information (UZ)
- ARTS and ARTCC Track information (TZ).

ETMS processes the above Host inputs and outputs these to FSM as Flight Plan - FZ, Departure - DZ, Track Update – TZ, Arrival - AZ, and NAS cancellation – RZ messages. FSM gets all the data for its displays, and to compute GDPs, from the ADL files.

6.2.2.5 Outputs

An ADL file is an ASCII file that consists of two main parts: a header and a data update section. The header consists of five fixed-format lines required by FSM, interspersed by some comment lines containing useful information about the report. The data update section consists of multiple blocks of data delimited by keywords. The bulk of an ADL file is the data update. It starts with a single line containing the day-hour-minute at which the update was generated, and ends with a single line that restates the update time.

FSM users can view the ADL information for a single flight by selecting Flight Details. An ADL file contains all data pertinent to running a ground delay program for arrivals at an airport. A particular ADL contains data for only one airport. The ADL is composed of sections each containing a particular kind of data:

- Departure and Arrival Fixes - ETMS inserts lists of the current arrival and departure fixes, if any, defined in the ETMS grid database. These records are always present.
- AARs and ADRs - ETMS inserts the default and current rates for the airport. A set of default rates is defined in a static data file for every airport that can be monitored in FSM. ETMS simply inserts the appropriate values. Authorized FSM users define the current ADRs and AARs in real-time using FSM. These records are always present.
- GDP Parameters - FSM sends GDP parameters to ETMS, which maintains a list of the current values for each type: proposed GDP, actual GDP, compression, ground stop, or blanket. This record is only present if a GDP has been issued. Once the GDP Parameters block appears in the ADL, it will stay in the ADL, even if a compression, blanket, or ground stop is issued, until one of the following conditions occurs:
  - The GDP is cancelled (purged).
  - A new GDP (revision or extension) is issued.
- When a GDP is cancelled, all of the lines in the block is removed and replaced by the text GDP_PGM_TERMINATED followed by the time of the cancellation in MMDDHHMMSS format. This message is retained until a new GDP, either actual or proposed, is started or until 0800z, whichever comes first.
- Compression Parameters: This record contains all the parameters specified when a specialist performs a compression of a previously issued ground delay program. It is similar to the GDP Parameters block and is only present when a compression has been performed. Once a Compression Parameters block appears in the ADL,

however, it will, like the GDP Parameters block, stay in the ADL until one of the following conditions occurs:

  – The GDP is cancelled (purged).

  – A new GDP (revision, extension, compression, blanket, or ground stop) is issued.

- Blanket Parameters: This record contains all the parameters specified when a specialist performs a blanket delay of a previously issued ground delay program. It is similar also to the GDP Parameters and Compression Parameters blocks, and only present if a blanket delay is issued. Once a Blanket Parameters block appears in the ADL, however, it will stay in the ADL until one of the following conditions occurs:

  – The GDP is cancelled (purged).

  – A new GDP (revision, extension, compression, blanket, or ground stop) is issued.

- GS Parameters: This record contains all the parameters specified when a specialist issues a ground stop using FSM. It is similar also to the GDP, Compression and Blanket Parameters blocks, and only present if a ground stop is issued. Once a GS Parameters block appears in the ADL, however, it will stay in the ADL until one of the following conditions occurs:

  – The GS is cancelled (purged).

  – A new GS (revision, extension, compression, blanket, or ground stop) is issued.

- When a GS is cancelled, all of the lines in the block are removed and replaced by the text GS_PGM_TERMINATED followed by the time of the cancellation in MMDDHHMMSS format. This message is retained until a new GS, either actual or proposed, is started or until 0800z.

- FADT File - A FADT file is the file that FSM generates whenever a set of EDCTs or FA delays is sent out. A GDP, compression, blanket program, and a ground stop all cause a FADT to be generated. The FADT Times block contains a list of each FADT file that has been generated during the current traffic management event at the airport. The FADT Times list shows each FADT that has been issued as well as the type of the FADT. The FADT list appears only if a traffic management initiative is in place for this airport.

- Sub Status - Traffic managers at the ATCSCC can turn airline substitutions capability on or off. When ETMS generates an ADL, it includes the current status for that airport. If the airport has no GDPs running, ETMS shows the subs status as off.

- Arrival and Departure Lists - ETMS includes a list of all arrivals and departures expected at the given airport, including cancelled flights, within the 1 hour in the past to 20 hours in the future time period (according to the ‘minus 1, plus 19’ rule). Each list includes the number of flights followed by a detailed record of each flight. For each arrival and departure, a record containing virtually every field in the ETMS

database is included, except for route-of-flight related fields. ETMS generates most of the flight data using the ETMS Request List function.

ETMS defines a flight as a flight leg; that is, an unique combination of call sign, origin, destination, and time of operation. For example, flight ABC1223 from BOS to ORD to SFO on 8/23/99 is two flights, one operating from BOS to ORD, another operating from ORD to SFO. Given this definition, the ARRIVALS and DEPARTURES blocks contain the following flights for the ADL time range:

- All flights that ETMS currently predicts to arrive or depart at the given airport in the ADL time interval.
- All canceled flights that, when they originally entered the ETMS database via an FS, FC, FM, or FZ message, were predicted to arrive or depart at the given airport in the ADL time interval.
- All flights that are diverted but that, when they originally entered the ETMS database via an FS, FC, FM, or FZ message, were predicted to arrive at the given airport in the ADL time range. [NOTE: The original diverted flight does not appear in the ADL if a diversion recovery is created with the same call sign.]

See Appendix C ADL Format for details and examples of ADL parameters.

6.2.2.6 Reference Sources

- *Enhanced Traffic Management System (ETMS) Functional Description, Version 7.4, Report No. VNTSC-DTS56-TMS-002*, dated June, 2002 (Draft); Volpe National Transportation Systems Center, U.S. Department of Transportation, Cambridge, MA
- *Aircraft Situation Display to Industry: Functional Description and Interface Control Document, Version 4.0, Report No. ASDI-FD-001*, dated August 4, 2000; prepared by Volpe Center, Automation Applications Division, Cambridge, MA
- *Volpe Memorandum* from Ken Howard to the CDM Group, dated 01 November 2001, Subject: *Arrival Demand List (ADL) Data Format for Version 5*

6.2.2.7 Miscellaneous

Version No: ADL V5.0

Development Languages: C

Platform: C servers

Software Maintenance Organization: Metron Aviation

6.2.3 Aircraft Situational Display to Industry (ASDI) Data Feed

6.2.3.1 Overview

ASDI is a data feed from the FAA that provides airlines and other aviation-related organizations with access to a subset of near real-time air traffic data (for IFR commercial and general aviation traffic) across the NAS. The ASDI feed is based around a client-server architecture. The ASDI server runs at Volpe Center, which is the ETMS Hubsite.

The ASDI server registers with ETMS to receive the flow of raw data from ETMS, filters out sensitive flights and message types before sending the data through a firewall to registered clients. A client registers with the ASDI Server to receive the ASDI data by opening a TCP/IP socket. There are two feeds: one that contains the London data and one that does not. A client is allowed to register with the feed that contains the London data if the data is used by an airline or by any aircraft operator that operates in Europe. Every client that connects to one of the ASDI feeds gets exactly the same data as any other client that connects to the same feed.

Only vendors are allowed to register directly with the Volpe Center; other users get data directly from the vendors and not from Volpe. It is left to the vendors to provide software that displays, monitors, and analyzes the ASDI data for their subscribed users.

Each ASDI vendor is responsible for installing and maintaining a router at the Volpe Center, a router at their facility, and a communications line between the routers. The router at the Volpe Center is connected to a firewall on the ETMS network to control vendor access to ETMS. TCP/IP is used for all communications between the firewall and the vendors. There are two ASDI servers and two firewalls to meet reliability requirements. Exhibit 6-79. ETMS to ASDI Interface shows the flow of ASDI data from ETMS to the ASDI vendors.

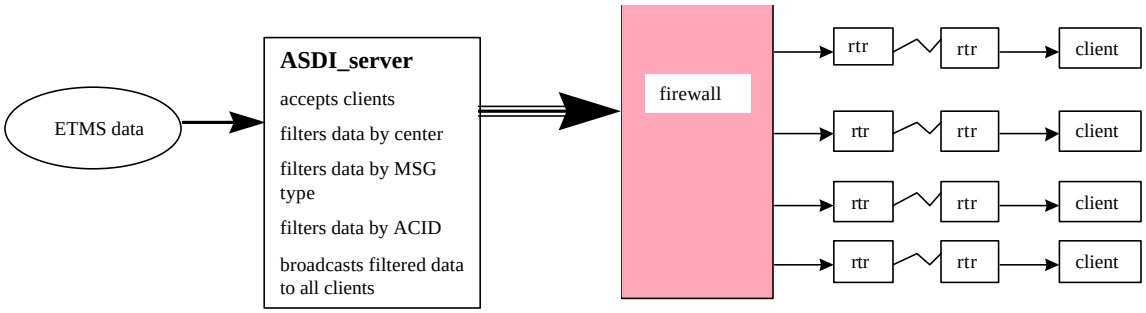


Exhibit 6-79. ETMS to ASDI Interface

6.2.3.2 Functions

ASDI feeds multiple data recipients, and each data recipient may have a number of subscribers. ASDI is an open system compliant program. It maintains an X-window to display statistics every minute. ASDI also creates an hourly log.

The ASDI server receives messages from ETMS and filters the messages before sending them over the ASDI feed. The ASDI server performs the following:

- Accepts client registration to receive data
- Registers with the ETMS Nas. dist process to receive raw (ASCII) data
- Filters out sensitive flights and message types. Military flights are not permitted in the ASDI data stream, and the only message types currently allowed into the ASDI data stream are AF, AZ, DZ, FZ, RZ, TZ, UZ, Route (RT), TO, and Heartbeat (HB) messages. Examples of message types that are filtered are the Beacon Code (BZ) and FS messages.
- Filters data by center
- Filters on ACID, originating data center, and field 11 (NAS remarks field)
- Broadcasts identical data to all connected clients using non-blocking write operations
- Data is discarded if the client's buffer overflows or if the client becomes disconnected
- Any write to a client resulting in an error condition terminates the connection; the client must re-establish a connection if it is to receive data.
- A "port filled" or "no room in port" condition is not considered to be an error; in these situations data is buffered for a later attempt to re-transmit

For efficiency, the Host computer at a center sometimes packs as many as seven TZ messages into a single message. The ASDI server splits such a composite message into individual TZ messages before sending them over the ASDI feed. Each filtered message is framed with a sequence number and a date stamp, and shipped to each registered recipient.

6.2.3.3 Interfaces

The ASDI communications software runs on 2 ASDI nodes at Volpe. A standard TCP/IP socket interfaces between the ASDI server running at the ETMS Hubsite and the client software running on the vendor's premises. As shown in the diagram above, a firewall controls the IP addresses from which clients are allowed to register. The system only sends messages to recipients (TCP/IP clients) who are currently connected.

Occasionally, customers report data loss from ASDI. The main communications process is the ASDI server process. The only means of resolving an ASDI problem at this time is to restart the software.

6.2.3.4 Data Sources

Data sources to ASDI are the ETMS data (from ETMS Nas. Dist process)

- All NAS messages received by ETMS

- All TO messages generated by ETMS
- All RT messages generated by ETMS

6.2.3.5 Outputs

The ASDI data feed includes the following message types:

- FZ (Flight Plan)
- AF (Flight Plan Amendments)
- DZ (Departures)
- UZ (Boundary Crossings)
- TZ (Track Updates)
- AZ (Arrivals)
- RZ (Cancellations)
- TO (Oceanic Track Updates)
- RT (Route Messages for every FZ, AF and UZ).

The ASDI feed includes:

- Filtered and sorted NAS messages provided by the FAA
- Filtered and sorted RT and TO messages generated by the ETMS server
- HB message.

A heartbeat message is sent to all connected clients every 10 seconds so clients know that the server connection is intact

6.2.3.6 Reference Sources

- *Aircraft Situation Display to Industry: Functional Description and Interface Control Document, Version 4.0, Report No. ASDI-FD-001,* dated 08/04/00; Volpe National Transportation Systems Center, U.S. Department of Transportation, Cambridge, MA
- *Enhanced Traffic Management System (ETMS) Functional Description, Version 7.4, Report No. VNTSC-DTS56-TMS-002,* dated June, 2002 (Draft); Volpe National Transportation Systems Center, U.S. Department of Transportation, Cambridge, MA

6.2.3.7 Miscellaneous

Version No: ETMS 7.5

Development Languages: C

Platform: HP

COTS Products Used: None

Software Maintenance Organization: Volpe

6.2.4 Flow Evaluation Area/Flow Constrained Area (FEA/FCA)

The TSD provides managers with the ability to define and display Flow Evaluation Areas (FEA) and Flow Constrained Areas (FCA). An FEA/FCA is a user-defined volume of airspace along with an associated flight filter. The traffic manager can define a geographic area of an FEA/FCA by drawing a polygon on the TSD display and defining the ceiling and floor of the FEA/FCA using a dialog box. Alternatively, the manager can designate a NAS element as an FEA/FCA. The traffic manager can also define the criteria for filtering the flights that are predicted to intersect the FEA/FCA. The manager also defines the time period for the FEA/FCA, which must end within the next 15 hours.

Created FEA/FCAs are stored in a distributed database so that they may be shared with other ETMS users. There are three types of FEA/FCAs: public, shared, and private. Severe weather specialists at the ATCSCC typically create public FCAs that are shared with all ETMS users. Users at ETMS field sites may create shared FEAs and share them with other ETMS users within their facility and other designated ETMS facilities. Shared FEAs are always shared with the ATCSCC. Any user may create private FEAs for viewing on their workstation. When the manager turns on the display of FEA/FCAs, the TSD display refreshes automatically to show the latest FEA/FCAs and new updates as they are received.

The manager can examine an FEA/FCA to determine the flights that are predicted to intersect the FEA/FCA. When an FEA/FCA is examined, the TSD displays a time line for the FEA/FCA that shows either the peak 1-minute occupancy count or the total occupancy count for each 15-minute interval from the FEA/FCA start time to its end time. The manager can request a display of a bar chart that shows the breakdown of these counts between active and proposed flights for each 15-minute interval. The traffic manager can also request FEA/FCA reports that list the flights that are predicted to intersect the FEA/FCA in each 15-minute interval and display the current flight positions for those flights.

The FEA/FCAs provide Traffic Managers with a mechanism to analyze the traffic expected in an area of severe weather and plan reroutes accordingly.

6.2.4.1 Miscellaneous

Version No: V7.5

Development Languages: C

Platform: HP-UX 11.0, Red Hat Linux 7.3

COTS Products Used: None

Software Maintenance Organization: Volpe

6.2.5 Operational Information System (OIS)

6.2.5.1 Overview

The Operational Information System (OIS) is a specialized informational system that provides critical and rapidly changing information to air traffic control personnel via the intranet. It was developed for the FAA by Kenrob & Associates to replace the MS-DOS based IDS4 operating system.

Air Traffic Specialists at the ATCSCC refer to the information contained in OIS when considering and implementing EDCT Programs and various other traffic management initiatives. The system stores data in an Oracle database for immediate retrieval when web pages are requested.

The OIS web site is divided into two frames.

1. Navigation frame - Located on the left side of the window and designed to help users navigate throughout the web site. This frame contains the current date, time and links to the various web pages.
2. Target Frame – Located to the right of the navigation frame and occupies the majority of the window. When OIS initially displays, the frame on the right populates with a generic OIS title page. This is replaced with a Summary page after a few seconds. When a link is selected from the navigation frame, the appropriate page is displayed in the target frame.

6.2.5.2 Functions

The OIS makes the following categories of information readily available to ATCSCC Intranet users.

- Summary
- Schedules
- East and West Directory
- Planning Team
- Severe Weather
- National Playbook
- Tier Information
- Checklists
- Airport Metrics
- Contacts
- RT FSA

- TCA Tool

Authorized ATCSCC users have the ability to add, modify, and delete information in many of these categories. Each category is described in the subsections below.

6.2.5.2.1 Summary

The Summary page is a quick reference to air traffic initiatives in effect at various airports. It is always displayed at the ATCSCC and at the TMUs, often in multiple places. The information on the summary page is dependent on data input by the ATCSCC specialists and FSM. ATCSCC specialists manually input reported information using OIS provided input forms. FSM automatically inputs data into the OIS Oracle database whenever it issues a GDP or GS. The OIS Summary page automatically refreshes once a minute.

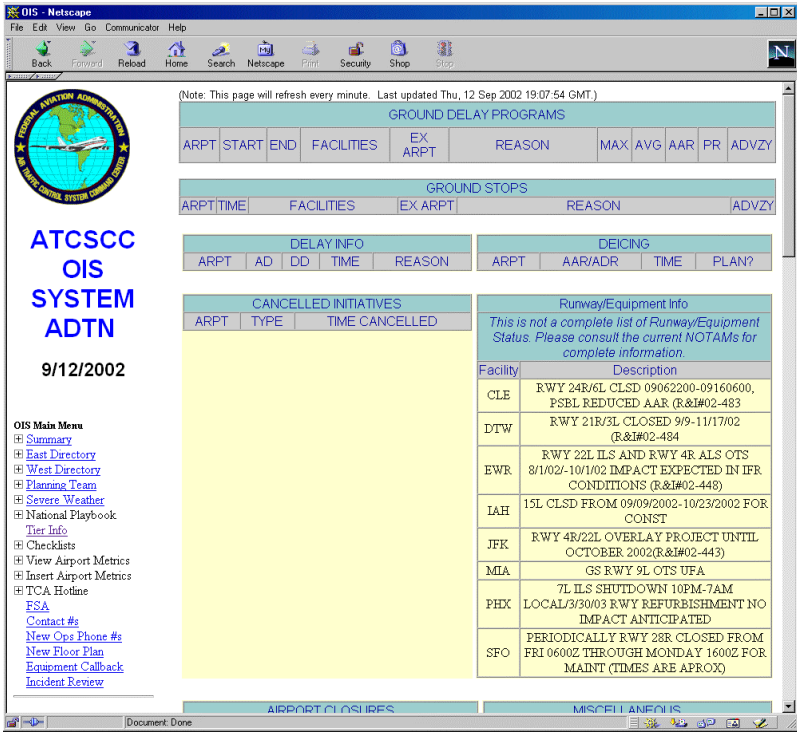


Exhibit 6-80. OIS Summary Page

The Summary page is divided into multiple tables. Authorized ATCSCC specialists can modify any table entry by clicking on the edit button. Each table is described below.

- The Ground Delay Programs table displays EDCT programs that have been initiated by the ATCSCC. The information is provided by FSM. Each table entry includes the airport for which the GDP has been issued, the GDP stop/start times, the facilities included in the program, exempted airports, reason for the GDP (i.e., runway, ceilings, visibility, or weather), maximum delay time, average delay time, AAR, the

acceptance rate the ATCSCC specialist determines is necessary to minimize the delays, and the GDP advisory number.

- The Ground Stops table displays ground stops that have been initiated by the ATCSCC. The information is provided by FSM. Each table entry includes the airport for which the GS has been issued, the time the GS is expected to end, the facilities included in the GS, exempted airports, reason for the GS, and the GS advisory number.
- The Delay Info table displays delays that are being experienced at various airports.

  Terminal facilities are required to report delays of 15 minutes or more to the Air Traffic Control System Command Center (ATCSCC). Delays are tracked in 15-minute increments. Delay times are preceded with either a '+' or a '-' to indicate that the delays are increasing or decreasing. Because the delays are tracked in 15-minute increments, a single delay entry actually represents a time range. For example, an entry of +15 indicates that delays are greater than 15 minutes but less than 30 minutes and are increasing. An entry of -30 indicates that delays are less than 30 minutes but greater than 15 minutes and are decreasing. Normally delays of less than 15 minutes are not shown. The one exception to this is when delays for an airport have just gone below 15 minutes. This is indicated by an entry of -15.

  The ATCSCC specialist manually enters the reported airport delays. Separate entries are maintained for an airport that is experiencing both arrival and departure delays. Each table entry includes arrival delay time, departure delay time, time the delay information was last updated, and the reason for the delay. An arrival delay typically indicates that arrival traffic is doing airborne holding. Depending on the length of the departure delay, traffic will be experiencing longer than normal taxi times or holding at the gate.

- The Deicing table displays a list of airports that have deicing programs in effect. The ATCSCC monitors airports that have implemented deicing to ensure that once an aircraft is deiced, it is not subject to traffic management initiatives that might delay its departure. Each table entry includes airport, AAR/ADR, time the airport started deicing aircraft, and a Local Airport Deicing Plan (LADP) indicator. Airports with an LDAP are exempted from traffic management programs, such as GDPs and GSs, while they are deicing. This helps ensure that aircraft are not delayed after deicing.
- The Cancelled Initiatives table lists the traffic management programs that have been recently cancelled. Each table entry includes the airport, type (GDP or GS), and the cancel time.
- The Runway/Equipment Info table is used to track equipment outages and construction for major airports that may result in air traffic delays. The list is not a complete list of all runway/equipment status. Users are instructed to consult the current NOTAMs for a complete list. Each table entry includes the facility and a brief, free-form problem description.

- The Airport Closures table lists the airports that are closed. Each table entry includes the airport, date/time the airport closed, reason the airport closed, and date/time the airport is expected to reopen.
- The VIP Movement table displays a list of scheduled VIP movements. VIP Movement generally refers to the President, Vice President, and heads of state from other countries.
- The Miscellaneous table displays a list of additional information that might be important to Air Traffic Specialists when making traffic management decisions (e.g., the time of the next planning telcon, specific NOTAM references).
- The West Flight Check Info table includes information on Flight Checks that are operating at airports located within the West Sector of the ATCSCC.

  Periodic inspections are made of NAS navigational aids. Specially instrumented aircraft performs some of these inspections. In order for the flight check instruments to make accurate measurements, certain phases of the flight check must not be interrupted. Because of this, flight inspections can cause minor air traffic delays.

  Each table entry includes the airport that will be flight checked, scheduled Zulu date/time of the flight check, scheduled local date/time of the flight check, and a brief description of what will be checked.

- East Flight Check Info table is identical to the West Flight Check Info table except it is for airports located within the East Sector of the ATCSCC.
- The GPS Status table shows reported GPS anomalies, anomaly date/time, aircraft affected, location of the anomaly, and whether the FAA has taken action to validate the presence of the anomaly.
- The Scheduled DOD Testing table shows scheduled DOD testing of known GPS anomalies, test date/time, locations of anomaly, and test details. This information is for planning purposes only. An official U.S. NOTAM will be issued within 72 hours of the actual test starting time.

6.2.5.2.2 Schedules

This OIS option allows the user to view the ATCSCC *day*, *mid*, or *evening* duty schedules. The schedule is divided into several sections. The top portion of the schedule identifies the shift designation, name of the NOM scheduled for that shift, and the shift date. Below the header information, the page is divided vertically between the East, West and Severe Weather sectors. The information in these sections indicates the various positions within the sector and the breakdown of the sectors by position. Other information that is reflected on the Schedule page includes the identity of individuals scheduled to work other positions such as CSA, CARF, Weather Unit, and NOTAM.

6.2.5.2.3 East and West Directory

The *East* and *West Directories* provide a path for accessing specific airport information within the sector. Information may be retrieved by "drilling down" either through the navigation frame entries or through the geographic maps in the target frame. As opposed to text list choices in the navigation frame, the maps provide users with a geographical perspective of the ATCSCC sector, ARTCCs, and location of airports within the ARTCCs. When the desired airport is located, the Airport Arrival Rate window is displayed. This window lists the airport's landing and departing runways, airport arrival rates, and aircraft Category Minimums. The window also includes links to

- AAR – This is the Airport Arrival Rate window that is initially presented, as described above.
- TM Tips - TM Tips refers to Traffic Management Tips for the airport. Examples of tips include the heaviest arrival fix, preferred operations for VFR conditions, the percentage of propeller traffic.
- Layout - Layout provides a plan view of the airport layout.

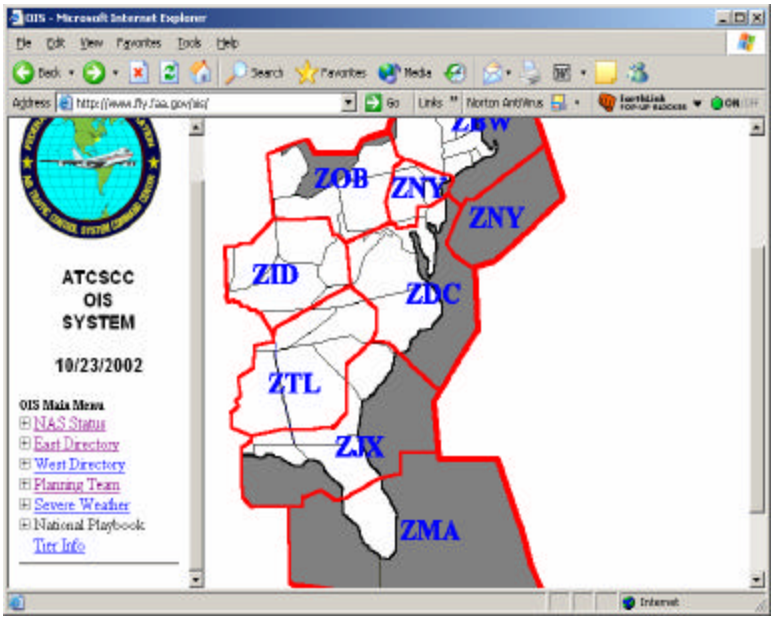


Exhibit 6-81. Interface for Map-based Drill Down (Public Website)

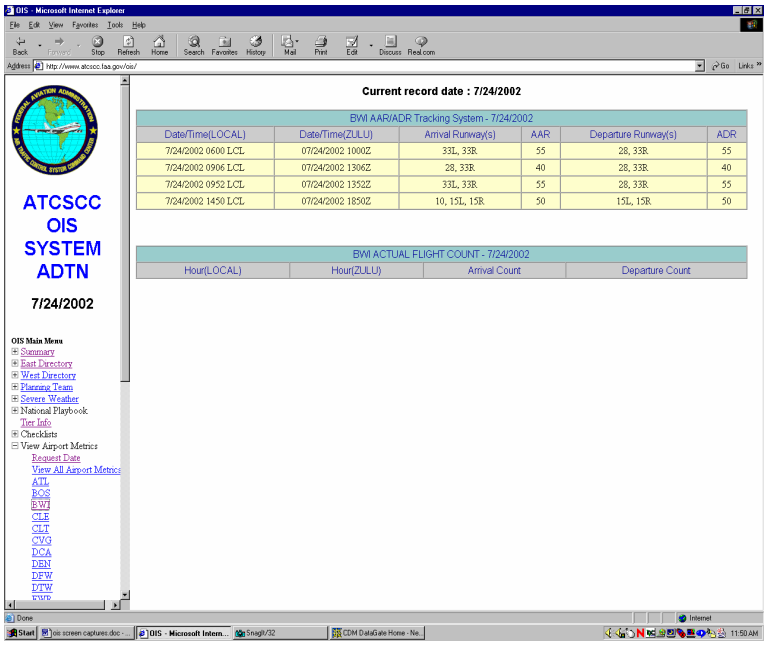


Exhibit 6-82. AAR Data for a Specific Airport

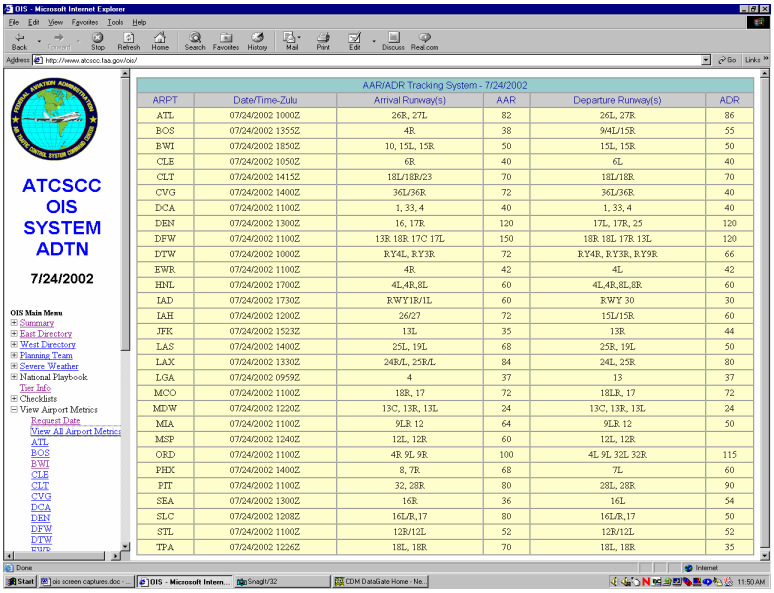


Exhibit 6-83. AAR/ADR Tracking

6.2.5.2.4 Planning Team

The OIS Planning Team category provides information to support the activities of the Strategic Planning Team (SPT). This OIS option allows users to browse the current and previous Strategic Plan of Operation (SPO), the most recent reroute advisory and the SPT TSD Image. Links are provided to the RMT and telcon worksheets and log.

- Strategic Plans – The SPT creates a new SPO using an OIS-provided entry form. The user completes the plan data. OIS notifies the user of any incorrect date or character on the date fields, or if any required information is missing. Upon completion of the entry process, OIS automatically updates the Workstation01 log and generates a pop-up message to advise the user that the SPO advisory is being sent. After the advisory is submitted, it is available on OIS for teleconference attendees to view. The current SPO page displays the latest SPO advisory and refreshes itself every 5 minutes. Users can also browse the previous SPO.
- Current Reroutes - Reroute advisories sent by an ATCSCC specialist via ETMS email are available for viewing on the web by clicking on the Current Reroutes link from the OIS navigation menu. The Current Reroutes Advisory page displays the most recent reroute advisory message. The page is updated every 5 minutes.
- RMT – OIS provides a link to the RMT so that users can determine the most efficient routing for avoiding severe weather or congested airspace.
- SPT TSD Image – OIS captures the TSD image from Wrkstation01 and converts it to a web-displayable format. The SPT TSD page is updated every 5 minutes.
- Telcon Worksheets - OIS makes two worksheets available, one for FAA users and one for regular telcon participant users. These are static pages for printing.
- Telcon Logs – OIS provides a web form that allows logging of participants for a telcon. Information entered on the log is added to an Oracle database for future analysis. It is also added to Wrkstation01 position log.
- Feedback – OIS provides a web form for SPO teleconference participants to send their comments via e-mail. OIS appends the completed form with the IP address and Hostname of the user's machine to ensue that the sender can be identified.

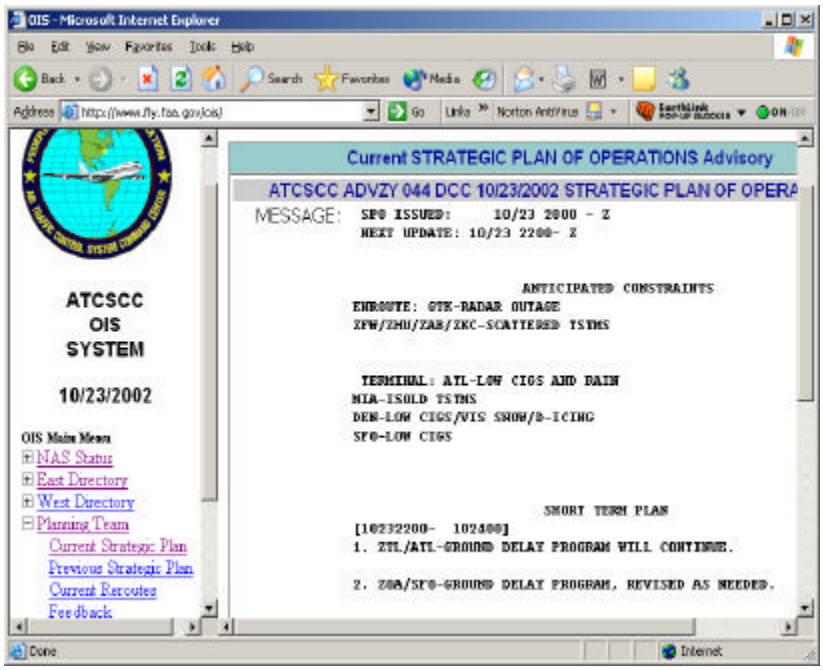


Exhibit 6-84. Example Current SPO Advisory on OIS (Public Website)

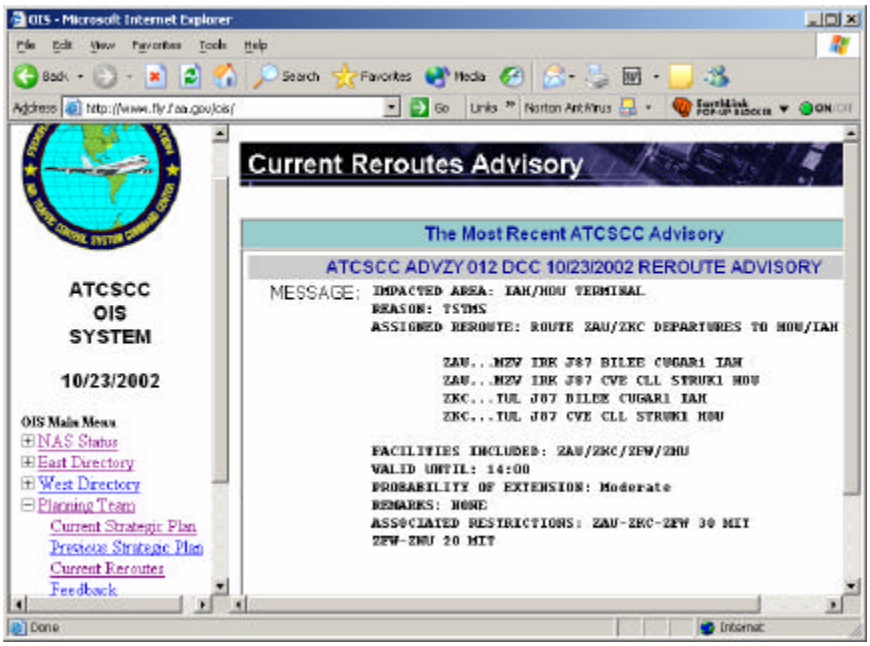


Exhibit 6-85. Example Current Reroutes Advisory on OIS (Public Website)

6.2.5.2.5 Severe Weather

The OIS Severe Weather category provides information to support the ATCSCC Severe Weather specialists. Most of the Severe Weather links are the same as those for the Planning Team. These include the Current Reroutes Advisory page, the RMT link, and an SPO Feedback form. Additionally, the SWAP 2000 Manual is available in PDF format for viewing, printing, and downloading using Acrobat Reader. The manual is currently being converted to HTML for viewing on the web.

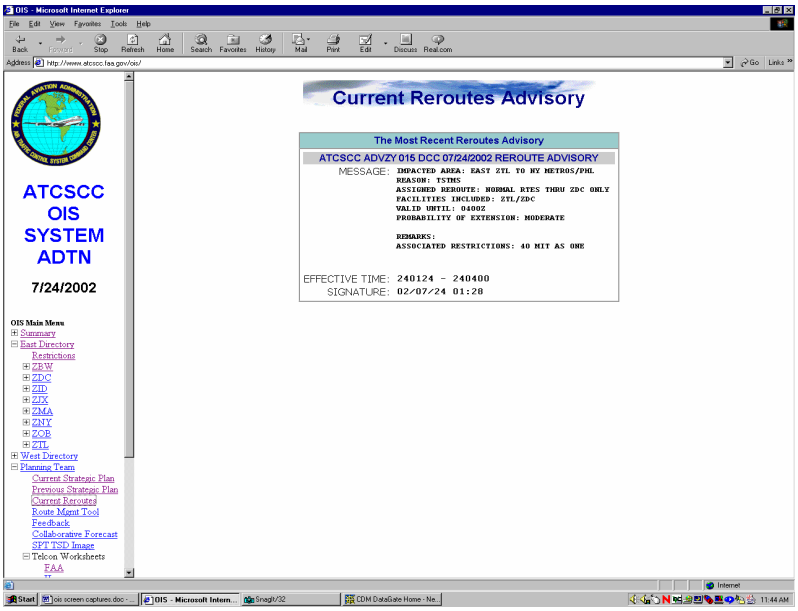


Exhibit 6-86. OIS Reroutes Advisory

6.2.5.2.6 National Playbook

OIS provides the current National Playbook for viewing and downloading. Both an HTML and an Adobe (.pdf extension) version of the Playbook are available for viewing. The Adobe version is more suitable for printing.

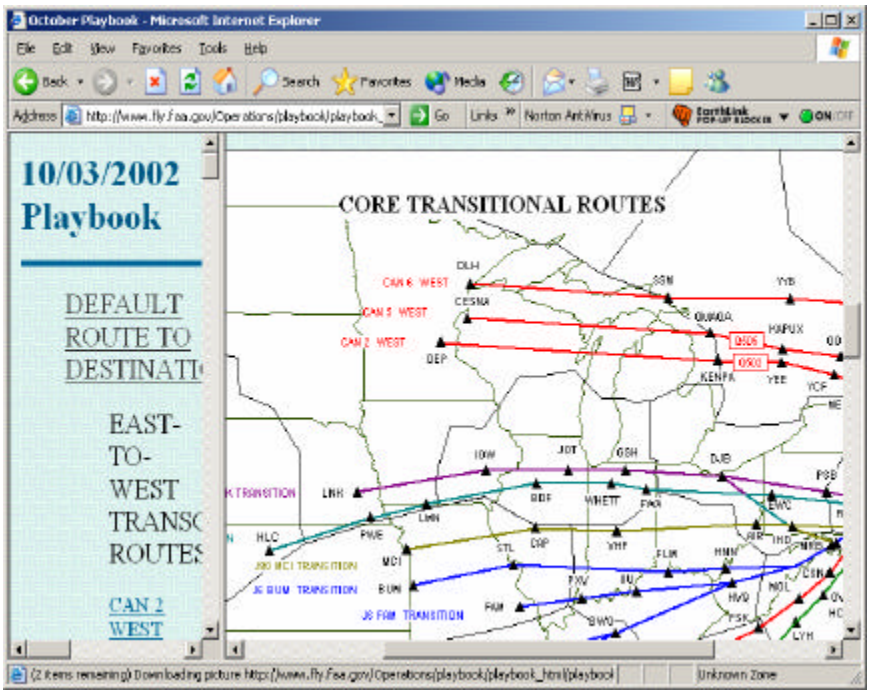


Exhibit 6-87. Playbook Example page: Core Transition Routes (Public Website)

6.2.5.2.7 Tier Info

When a delay program is initiated for a particular ARTCC, a "ripple-effect" occurs. Generally, first tier and sometimes second tier ARTCCs are affected. The *Tier Info* page provides a visual reference to the first and second tiers for each ARTCC. The first tier includes those ARTCCs that border or touch a particular ARTCC. The second tier includes ARTCCs that border or touch any of the ARTCCs included in the first tier. By selecting *Tier Info* in the OIS navigation frame, a map of the United States is displayed in the target frame, including all labeled ARTCCs. Clicking anywhere within the desired ARTCC allows the user to view tier information for a particular ARTCC. The map changes to depict color-coded first and second tier information. For example, the selected ARTCC is depicted in gray, the first tier ARTCCs are depicted in yellow, and the second tier ARTCCs are depicted in blue. A text description of the first and second tiers is also included in the bottom portion of the page.

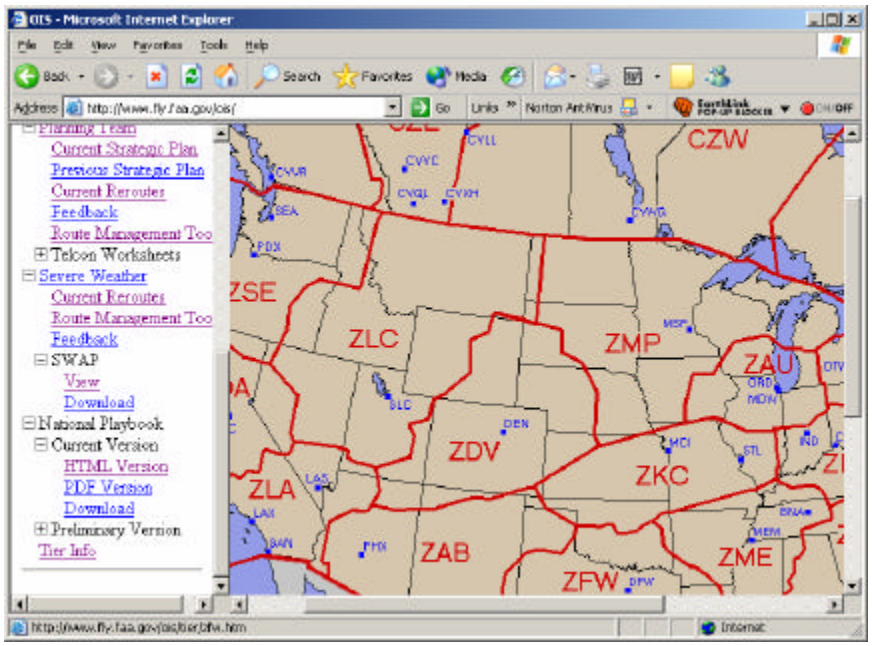


Exhibit 6-88. Initial Tier Information Display (Public Website)

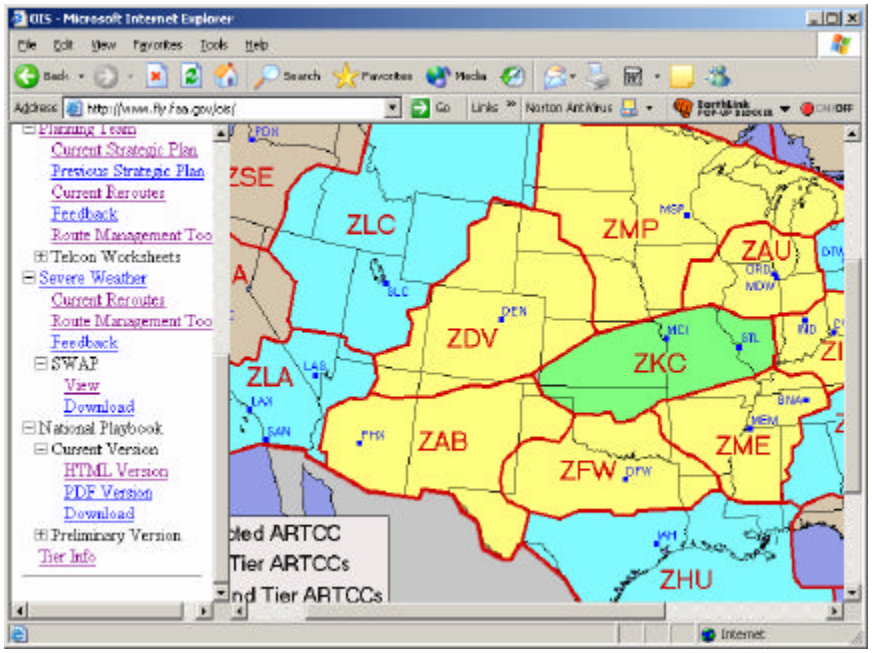


Exhibit 6-89. ZKC Tier Information (Public Website)

6.2.5.2.8 Checklists

OIS provides checklists that are most often used by the Air Traffic Specialists on the Command Center floor. The following checklists are available:

- Ground Delay Program Checklist
- East / West Position Relief Briefing Checklist
- Severe Weather Area Position Relief Briefing Checklist
- Tactical Adjustment Checklist
- Restriction Process Checklist
- Watch Supervisor Checklist
- ATCSCC Weather Unit Position Relief Briefing Checklist.

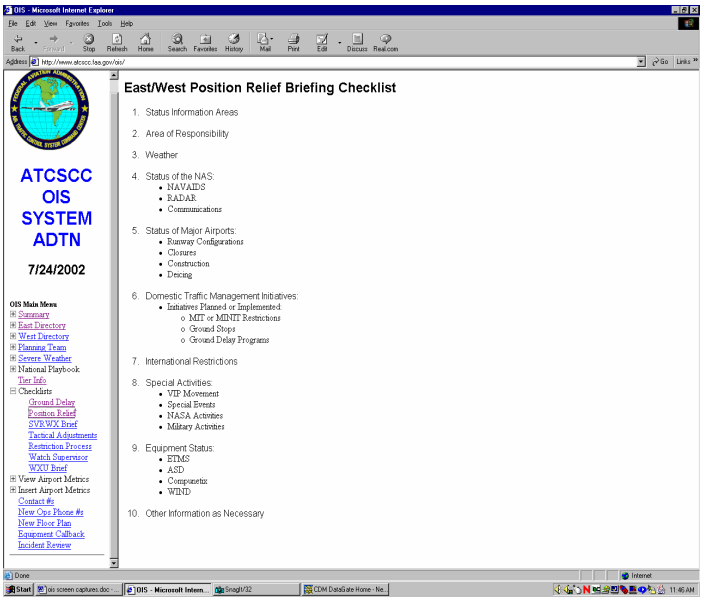


Exhibit 6-90. OIS East West Position Briefing Checklist

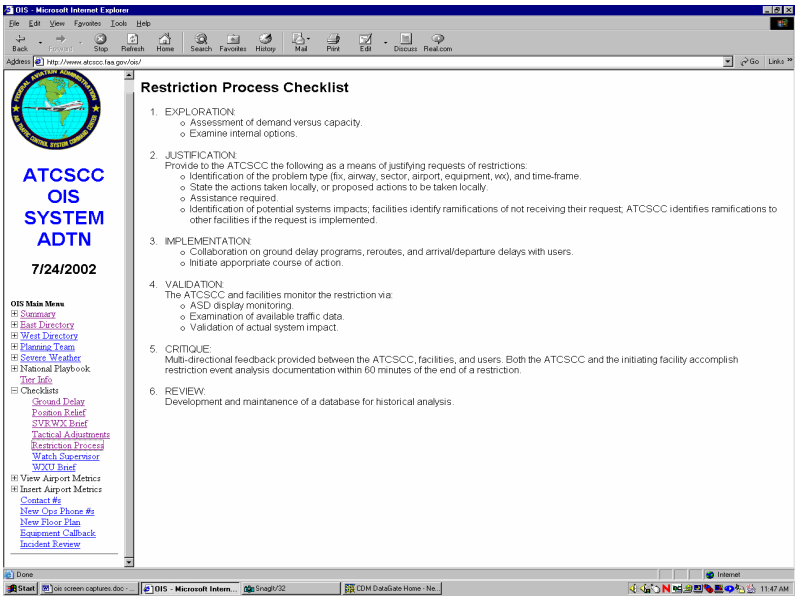


Exhibit 6-91. OIS Restriction Process Checklist

6.2.5.2.9 Airport Metrics

OIS provides airport metrics data for the pacing airports. Metrics data can be requested for a specific pacing airport or for all pacing airports for a particular day. The following metrics are displayed: metric date/time, arrival runways in use, AAR, departure runways in use, and ADR. Arrival and departure counts are also provided when metrics for a specific airport is requested.

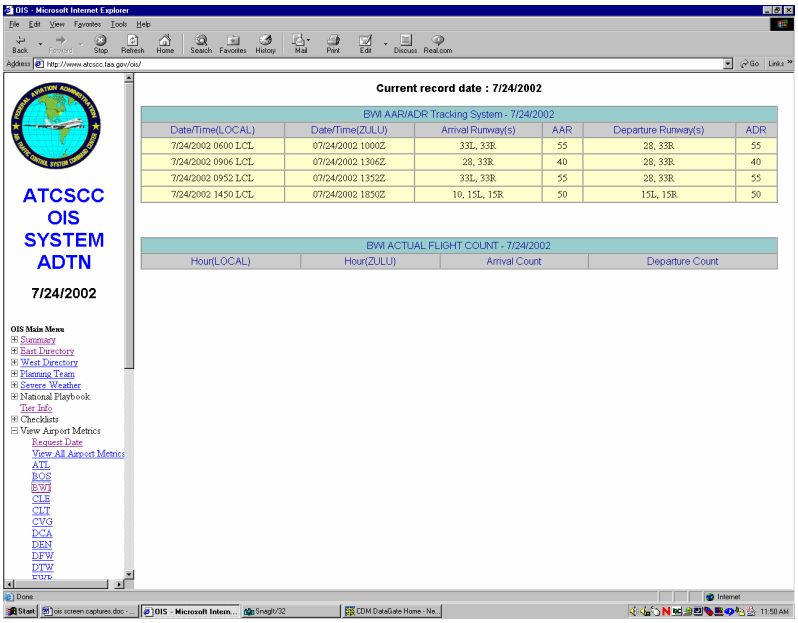


Exhibit 6-92. OIS Airport Metrics data for a selected date

6.2.5.2.10 Contacts

Contact information is provided for ATCSCC staff, operational positions, and equipment support.

6.2.5.2.11 Real Time Flight Schedule Analyzer (RT FSA)

Real-time FSA application generates a collection of dynamic web-based reports that allows the ATCSCC to monitor GDPs as they are executing. Reports generated are: (1) Performance; (2) Flight status; (3) Compliance; (4) Cancelled flights that operated; (5) Pop-up flights; (6) Time-out delayed flights; and (7) GDP Program events. These reports are dynamically updated every five minutes as new flight information is received. Drill-down features allow the user to interactively query the database for additional flight information. RT FSA is available to specialists and airlines via OIS. See Section 5.3.4, Analyze TM Initiative Effectiveness, for screen captures of the RT FSA interface. Also see Section 6.1.13, FSA, for additional information.

6.2.5.2.12 TCA Tool

The TCA Tool supports the TCA Hotline function to resolve pressing user issues during busy periods (i.e. such as during severe weather or national emergencies). Airline users and the ATCSCC TCA specialists access the TCA pages for reporting / resolving issues as well as for reviewing current and past issues and resolutions.

There are several pages available for the TCA Hotline function:

- TCA Hotline/Issue Page - Accessible/viewable to all with records that can be sorted. Issues in blue indicate that they are currently being worked by the specialist. Issues not being worked on are color coded by category.
- New TCA Issue Page - Accessible to all to create a new issue identifying the aircraft ID, time, category level, and description of the issue. A display-only list of what issues belong in which category is accessible from this page.
- TCA Specialist Page - Accessible only by TCA specialists at the ATCSCC to edit records as well as archive a record and flag a record as an issue being worked on, shared or resolved.
- Archive Pages - Accessible to all, this page allows users and specialists to see archived issue records. Resolved issues can be reviewed by accessing the two-hour archive. Issues are also kept on display for two days and can be found in the two-day archive. A 'More' feature provides users with the ability to see all information recorded about a resolved issue.

The system has security built in so that it does not allow someone other than the creator of the record to edit the record. This prevents airline A editing Airline B records.

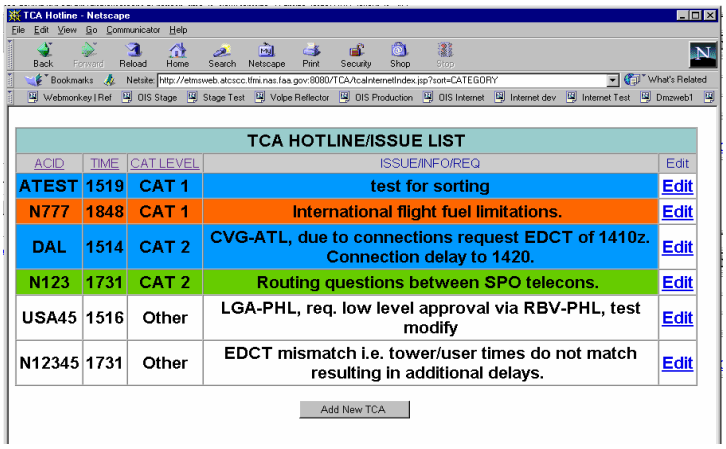


Exhibit 6-93. TCA Hotline/Issue List Page

6.2.5.3 Interfaces

OIS is accessible to all facilities with ADTN2000 connectivity, such as all ARTCCs, Regional Offices, and some TRACONs. Major airlines also can access the web site through the CDMnet. The URL for the OIS intranet site is http://www.atcscc.tfmi.nas.faa.gov/ois. The URL for the OIS Internet site is http://www.fly.faa.gov/ois/.

The Strategic Plan and Severe WX sections are available from the Intranet at http://atcscc.tfmi.nas.faa.gov/ois/ and from http://www.atcscc.faa.gov/ois/ (select Strategic Plan or Severe WX on the left navigation menu). A new SPO Advisory is sent via web through ETMS email.

6.2.5.4 Data Sources

FSM provides GDP and GS information for the OIS Summary page. Wrkstation01 provides the TSD image for the Planning Team OIS category. The Current Reroutes page retrieves the current reroutes advisory from the Advisories Database. OIS links to the RMT.

Users provide input to:

- Add a SPO Advisory
- Submit an SPO TELCON form and complete an SPO TELCON log
- Provide SPO feedback (comments)

Authorized users may add, modify, or delete the following information from the Summary page:

- Ground Delay Programs
- Ground Stops
- Delay Information
- Deicing
- Cancelled Initiatives
- Runway/Equipment Information
- Airport Closures
- Miscellaneous Information
- VIP Movement
- East/West Flight Check Information
- Reported GPS Anomalies
- Scheduled DOD GPS Anomaly Testing.

Authorized users may edit the Schedule information for a specific day.

6.2.5.5 Outputs

All OIS functions provide output to the web-based user interface. OIS input information is output to an Oracle database. SPO advisories are sent via ETMS e-mail to SPT members. SPO advisory information and SPO telcon log information are entered in the Wrkstation01 position log.

6.2.5.6 Reference Sources

- *Strategic Plan / Severe WX Web Application*, dated 3/9/00; FAA (ATT-220)

- *Operational Information System User Guide*, dated 5/21/99; FAA (ATO-240)
- *OIS Internet Web Site Help Information*; http://www.fly.faa.gov/oishelp/index.html

6.2.5.7 Miscellaneous

Version No: N/A

Development Languages: Java

Platform: Windows 9X/NT/2000

COTS Products Used: Oracle

Software Maintenance Organization: Kenrob and Associates

6.3 Local TFM Tools

This section describes tools that have been locally developed or acquired that were observed to be in used by the Audit Team at Washington ARTCC (ZDC), Chicago ARTCC (ZAU), New York TRACON (N90), and Southern CAL TRACON (SCT).

6.3.1 Blue Log

The TMCs at ZDC and N90 use the 'Blue' Log to record actions/activities taken at their positions. The information logged includes the TMC on duty, configuration status, weather updates, and all coordination activities. Restrictions, military activities, and any unplanned equipment outages are also included in the Blue Log. A Daily Record of Facility Operation report is generated from these TMC log entries.

The information provided by this tool is all locally entered and used by all TM positions at ZDC and N90. The Blue Log was developed at ZNY. It is DOS-based, and includes a number of templates which capture log entries for further analysis.

6.3.2 N90 SIA

The N90 Status Information Area (SIA) tool is a homegrown restriction status display tool used in the New York TRACON (N90) and its underlying towers. Restrictions are entered and removed by N90 TMCs only. N90 SIA is installed in the towers that underlie N90 so that tower controllers and traffic managers can reference the current TM restrictions.

6.3.3 N90 TCAP

The Traffic Count Automation Program (TCAP) is associated with the ARTS system. It automatically calculates traffic counts and provides hourly counts of traffic at each airport. TCAP calculates IFR/VFR arrival, departure and overflight traffic, and inter-facility point-out aircraft. TCAP traffic counts are included in OPSNET reporting.

When the ARTS is unavailable, TCAP is not functional. When TCAP is unavailable, each N90 area records its traffic counts on the TCAP Manual Form. When TCAP returns to service, traffic counts from the TCAP Manual Form are entered into TCAP. According to the N90 Operations Manager, the TCAP/ARTS is reliable and, although TCAP Manual Forms are available, there is no need to use them.

6.3.4 SAIDS

SAIDS is an integrated COTS/NDI system produced by Systems Atlanta, Inc. (SAI) and Systems Management, Inc. (SMI).

SAIDS installations are sometimes referred to as SAIDS, IDS4, IDS5 or ACE-IDS. Each name refers to a different system release of the product. SAIDS is the original name given to these products, and seems still to be a generic name. It is probable that not all facilities are using the correct terminology to describe the particular Systems Atlanta version (hardware/software) that they have. These information systems were licensed from Systems Atlanta on a facility-by-facility basis, which means many versions may be out in the field at the current time. This description uses the generic term, SAIDS, to refer to any Systems Atlanta information display system installed within a TMU.

SAIDS Functions

SAIDS displays reference data, such as maps, charts, diagrams, and procedures. At locations where SAIDS is equipped with external data interfaces, the system also displays automatic updates of live data collected from NWS and/or NAS data sources. These include but are not limited to:

- Automated Surface Observing System (ASOS)
- Digital Altimeter
- Flight Data Input/Output System (FDIO)
- Low Level Wind shear Alert System (LLWAS)
- Runway Visual Range (RVR)
- Official time source
- Terminal Doppler Weather Radar Wind shear (TDWRW)

The information contained in a SAIDS database is site specific, and so are the layout, type, colors, and amounts of information that reside on any given page. Each SAIDS page may contain an indefinite number of textual, image, or graphical objects.

SAIDS originated as a product almost exclusively for ATC but has evolved into a product that can serve many different sectors of the aviation industry simultaneously. Facilities using SAIDS include ATCTs, TRACONs, ARTCCs, Automated Flight Service Stations (AFSSs), maintenance control complexes, training facilities, airlines, satellite airports, airport management and operations, military bases, the WJHTC, and the FAA Logistics Center.

Refer to the Systems Atlanta web site at http://www.systemsatlanta.com/ for a more detailed discussion of SAIDS product capabilities and a list of sites using their products.

SAIDS in TFM Facilities

At the ATCSCC, SAIDS has been replaced by the OIS.

The Chicago Center (ZAU) TMU uses SAIDS to provide a common situational awareness link among local facilities (TRACON/towers) under their jurisdiction. RVR data is included on the ZAU SAIDS. The page containing RVR data remains displayed in the ZAU TMU. This page is preferable to using OIS or ETMS for RVR data because it is automatically updated. ZAU specialists make most of the manual updates to SAIDS, including TM Initiative updates. However, the Chicago TRACON has its own SAIDS page and is responsible for updating it. Some airlines, specifically United Airlines, have a workstation that is tied into the ZAU SAIDS from which a subset of the SAIDS displays may be viewed.

The New York TRACON (N90) uses SAIDS to inform TRACON controllers of the current restrictions. It does not use SAIDS to communicate with the towers. Rather, N90 uses a home-grown restriction status tool to communicate restrictions to the towers.

6.3.5 SCT CTAS Terminal

Two Free Flight software tools make up the Center TRACON Automation System. CTAS is the combination of TMA and CTAS Terminal, increasing arrival acceptance and efficiency of air traffic operations in airspace surrounding major airports. CTAS helps controllers optimize traffic flow into adapted airports and efficiently use available runways and surrounding airspace. Displays depict the aircraft approaching the runways and airspace in time line displays. Controllers can observe potential imbalances and use the data to suggest optimal solutions. No decrease in safety or increase in controller workload occurs.

While TMA aids in optimizing traffic flow in the extended airspace around an airport, the CTAS Terminal tool helps controllers optimize the flow to touchdown. The Southern California TRACON is using CTAS by having auxiliary displays of the data at the controller positions and large screen displays at the traffic management unit. This adaptation of the tool has increased dependability and doesn't require a digital infrastructure or extensive development.

CTAS Terminal data shows airline benefits of fuel savings and reduced delays. It maximizes runway use and provides an enhanced situational awareness at the TRACON. A 3% increase has been demonstrated at LAX.

The developers of the system are NASA Ames, CSC, and Northrup/Grumman Logicon in Fort Worth, Texas.

6.3.6 SCT Demand Spreadsheet

SCT Demand Spreadsheet is another tool, developed at Southern CAL TRACON, to support their operations. The Demand Spreadsheet contains demand and actual data for airports within SCT. It also records runway allocation. The demand numbers come from ETMS twice a day and are entered into this spreadsheet. The demand and actual numbers are included in the Daily Briefing Package.

6.3.7 SCT Performance Data Analysis & Reporting System (PDARS) Tool

PDARS is a tool being developed in cooperation among FAA, NASA, and ATAC. It is used at the ATCSCC; SCT, ZOA, ZLA, and ZID facilities; and the Southwest regions.

PDARS provides for analysis of traffic and events using beacon codes from ARTS and Host data. It can display beacon tracks within a given time span for a airport, replay flights in either direction and stop/freeze the frames, and look at actual tracks into a specific airport in 3 rotating directions. SCT can measure efficiency of a route by first using POET and then using PDARS to drill down for the details. PDARS can examine singular events to local or full traffic at a facility.

PDARS is very user friendly and much faster than POET, however, it is generally used for analysis of events the day after the events at the present time. It is being enhanced to provide real time analysis.

Some of the studies conducted using the PDARS tool by SCT were:

- LAX Arrival Study – study of distribution of LAX arrivals by fix with special emphasis on the number and proximity arrivals over VTU.
- BUR, VNY, WHP Departure Study – study to quantify the number of P and Q departures from BUR, VNY, and WHP which landed SCT airspace.
- Anaheim 2 Departure Study – study to quantify the number of P and Q class aircraft that depart via the Anaheim 2 departure Lake Hughes Transition from LGB, SNA, and FUL on a daily basis.
- On at least one occasion, PDARS was also used in more 'real time' mode, to assist in finding a 'lost aircraft', by displaying the aircraft's track as far as the Mexican border.

6.3.8 SCT Traffic Counters

The SCT Traffic Counter is another locally developed tool implemented by Southern CAL TRACON to support their operations. The Traffic Counter records the arrival rate, total traffic, and mix of traffic within SCT airspace.

SCT also records traffic from data off the ARTSIIIE system. It records the number of props, jets, and heavy aircrafts and their totals plus the number of arrivals and departures and their totals. This data is input to the OPSNET reports.

6.3.9 TMC Tools

TMC Tools is a flexible, PC based, tool developed by at ZNY to provide common situational awareness between and inside various TMUs. It is used in several northeast corridor facilities, including ZNY, N90 and ZDC. ZDC TM Specialists refer to it as their ESIS alternative.

TMC Tools can also act as an inter-position communication tool.

TMC Tools is configured locally to provide any number of functional capabilities. At ZDC, the interface is set up to allow specialists to access commonly needed display capabilities using a menu system. It provides specialists with a means to enter and view restrictions, textual weather, and other flow related information necessary to effectively plan and execute TM Initiatives.

At ZDC, the TMC Tools configuration provides access to the DCC Playbook and the ATCSCC Intranet (for OIS). It has been set up with a menu system to support access to enter and view static and dynamic local information about Restrictions, Ground Stops, Special Activities, and Ground Delays, Airport status (including runways in use and airports in SWAP), and APREQs.

A restriction 'status board' page shows current restriction status using a template like the following:

Fix/Range	Area	Restriction	Start	Expiry	Action

Exhibit 6-94. TMC Tools Restriction Template format

TMC Tools can be set up to connect to a variety or systems or websites to collect, display or enter information. At ZDC, it has a link to the ATCSCC Intranet website.

Data is acquired by manual entry at the TMC or Supervisor positions, or by viewing data on the ATCSCC Intranet site.

TMC Tools provides a configurable data display to accommodate any TM requirements for textual information display.

6.3.10 ZAU MAU Tool

ZAU MAU is a locally developed, standalone application used in the MOS area of Chicago Center for producing strips and summaries of active military areas to be used in the various Center control areas.

The MOS enters all hot military activity areas manually. He deletes them as they go 'cold'. No data is retained long term in ZAU MAU.

The only functions the ZAU MAU program performs are: Add New (hot area), Delete (cold area), Print (strips and summaries).

ZAU MAU sits on a single non-networked PC. It has been configured to use the local FSP and another printer.

All data is manually entered. Data entry fields include the following:

- Time to/from
- Airspace
- Altitude
- Control (sector)
- Comments (including callsigns and types)

ZAU MAU outputs are as follows:

- Produces strips for North Area (5 sectors) via the FSP located in the MOS area.
- Produces printed summary for North, Northeast, Southeast/South areas.
- Also produces teletype forms for sending out MOAATCAA notifications.

Exhibit 6-95. ZAU MAU Output Strip Example is an example strip output from the FSP in the MOS area as a result of entries made in the ZAU MAU program.

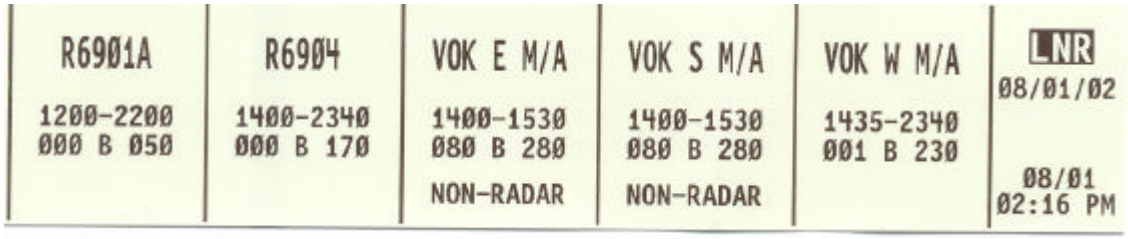


Exhibit 6-95. ZAU MAU Output Strip Example

Summaries are handed to the Area Supervisors by the MOS. The Supervisor for each area posts the summary to the area ESIS. When an area goes 'cold', the MOS manually deletes it from ZAU MAU.

6.3.11 ZAU Monitor Alert Tool

The ZAU Monitor Alert tool is a homegrown, windows-based tool used by the ZAU Supervisory Traffic Management Coordinator (STMC) to log/display sectors for which ETMS has generated a Monitor Alert. As the ZAU Restriction Manager shows, the following information is captured: alerted sector, start/end times, expected impacts, action taken, and the supervisor's initials. New alert entries can be entered, existing alert entries can be modified, and the alerts for the day can be printed.

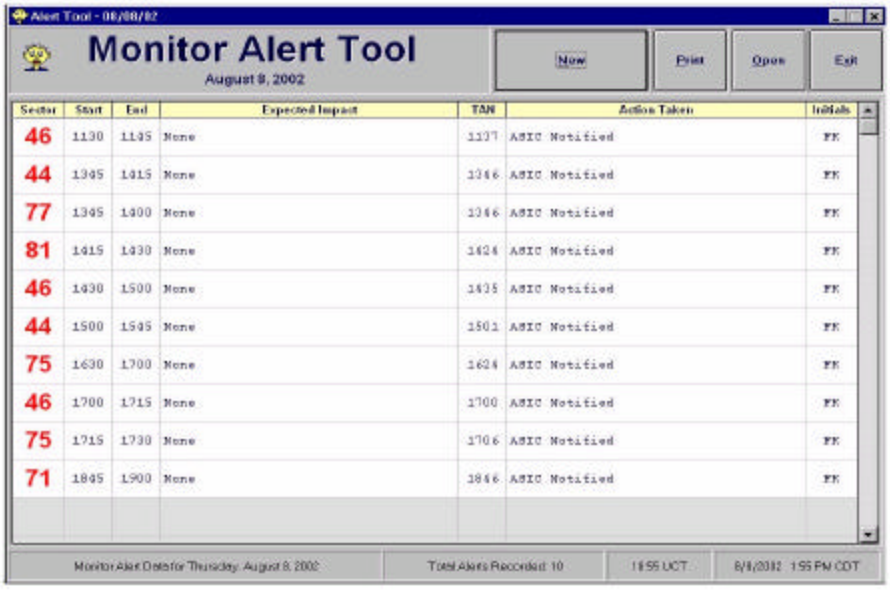


Exhibit 6-96. ZAU Monitor Alert Tool

6.3.12 ZAU Restriction Manager

ZAU's Restriction Manager tool provides TMCs at Chicago Center with capabilities to:

- Add restrictions.
- Modify restriction status.
- View restrictions.
- The information provided about restrictions include:
- Start / stop times for the restriction
- Fix restriction is applied to
- Restriction description
- Requested facility
- Facilities the restriction has been coordinated with.

The information provided by this tool is all locally entered and captured as text in ACCESS database. This tool is used by the Arrival, Enroute, and Restriction Coordinators at ZAU.

Exhibit 6-97. ZAU Restriction Manager captures illustrate some of the functions of ZAU Restriction Manager

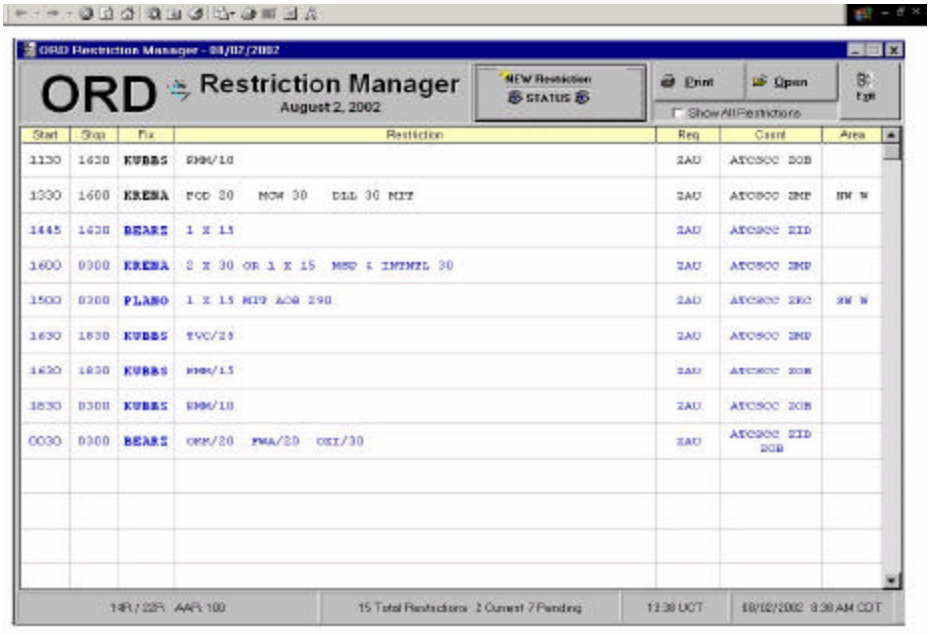


Exhibit 6-97. ZAU Restriction Manager (1)

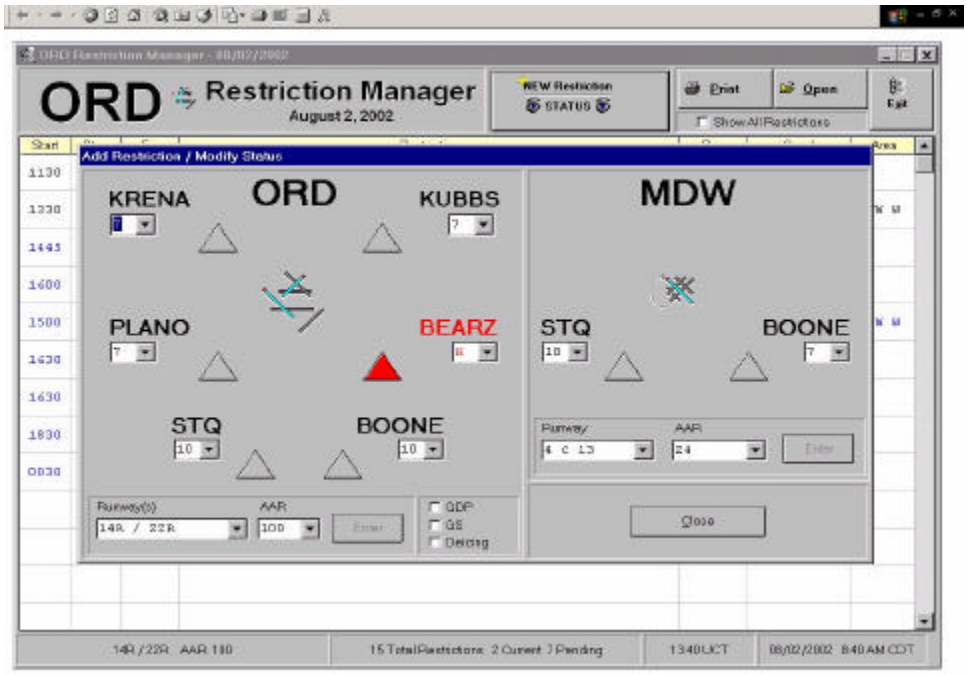


Exhibit 6-98. ZAU Restriction Manager (2)

6.3.13 ZAU SWAP Tool

The ZAU SWAP Tool allows the TMCs at ZAU to search for all SWAP routes from Chicago O'Hare and Midway airports to other Centers. As seen in Exhibit 6-99. ZAU SWAP Tool, the search capability provides a list of all SWAP codes, SWAP routes, and the total number of routes meeting the search criteria.

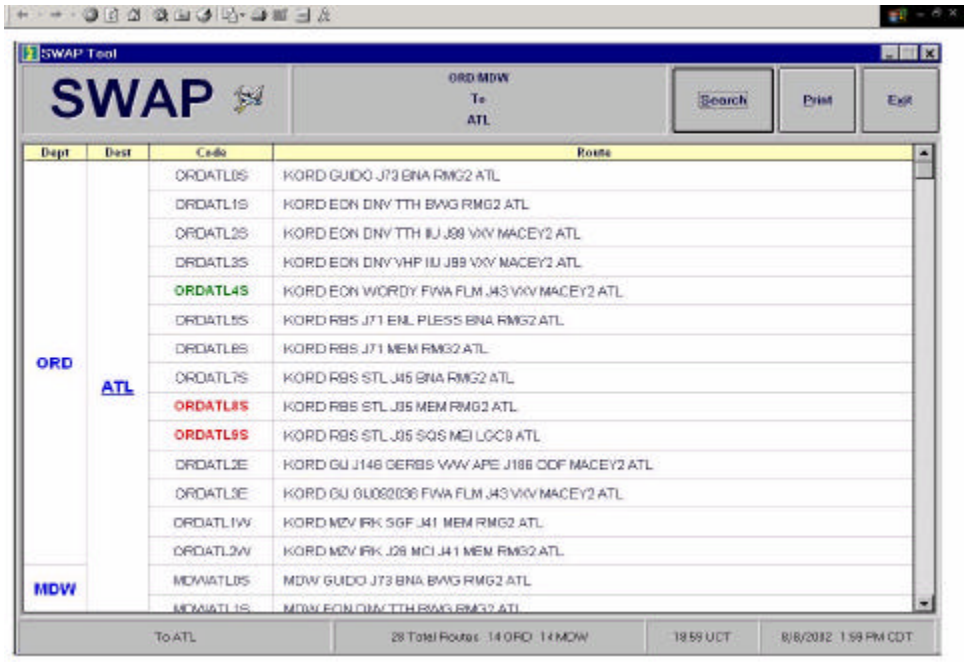


Exhibit 6-99. ZAU SWAP Tool

6.3.14 ZAU TMU Information Manager

ZAU's TMU Information Manager tool provides:

- Departure Flow Management information.
- Arrival/Enroute Flow Management Information.
- GDP/GS Information.
- Delay Information.

Departure Flow Management provides the following information about departure restrictions for ORD and satellite airports for the day:

- Start/stop times for departure restrictions.
- Direction of the departure restriction.
- Total departure restrictions for the day and the number of current and pending departure restrictions.

Arrival/Enroute Flow Management view provides the following information about arrival/enroute restrictions for airports within ZAU for the day:

- Start/stop times for the arrival/enroute restrictions.
- Airport with the restrictions.
- Description of the restrictions.
- Requesting ARTCC.
- Coordinating facility.
- Total restrictions for the day and number of current and pending restrictions.

GDP/GS view provides:

- Airport with the GDP and GS
- Start/stop times of the GDP or GS.
- Reason/comment on the GDP/GS
- Coordinating facility
- Total number of GDPs and GSs and number of current and pending GDPs and GSs.

ATCSCC Delay View provides the following:

- Arrival and departure delays for ORD and MDW

- The information provided by this tool is all locally entered and captured as text in ACCESS database. This tool is used by the Arrival, Enroute, and Restriction Coordinators as well as the supervisor at ZAU.

Screen captures of the following functions are shown in Exhibit 6-101. ZAU TMU Information Manager:

- Departure Flow Management
- Arrival / Enroute Flow Management
- GDP / GS
- Delays.

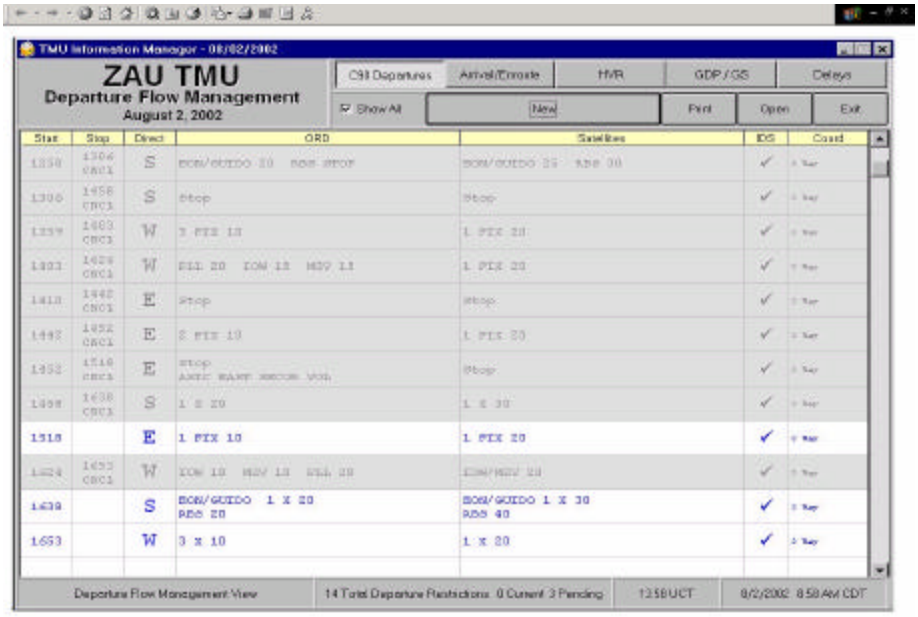


Exhibit 6-100. ZAU TMU Information Manager (1)

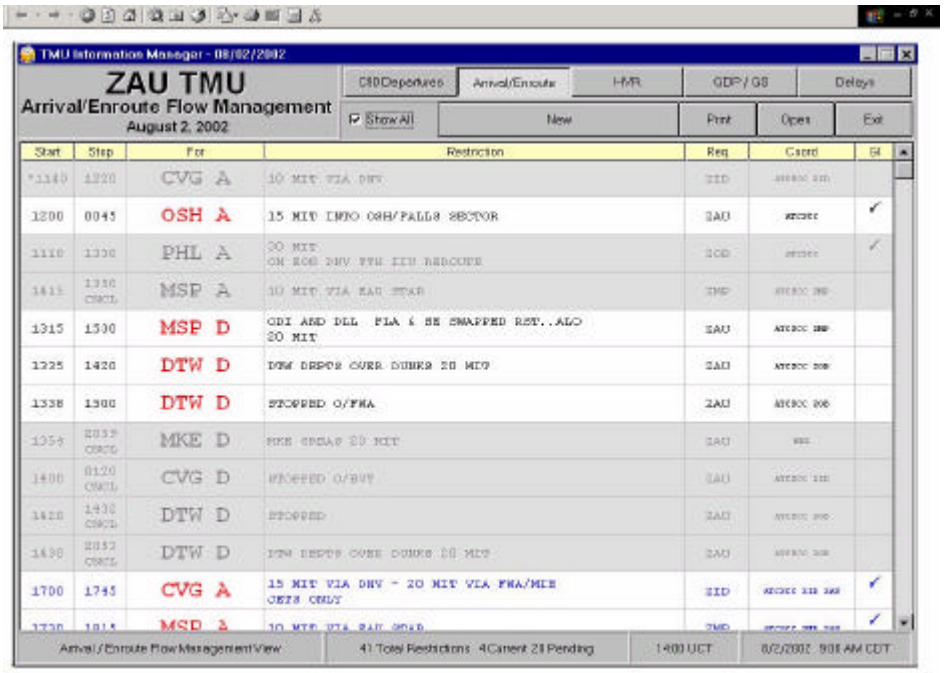


Exhibit 6-101. ZAU TMU Information Manager (2) Arrival/Enroute Flow

Exhibit 6-102. ZAU TMU Information Manager (3) GDP/GS

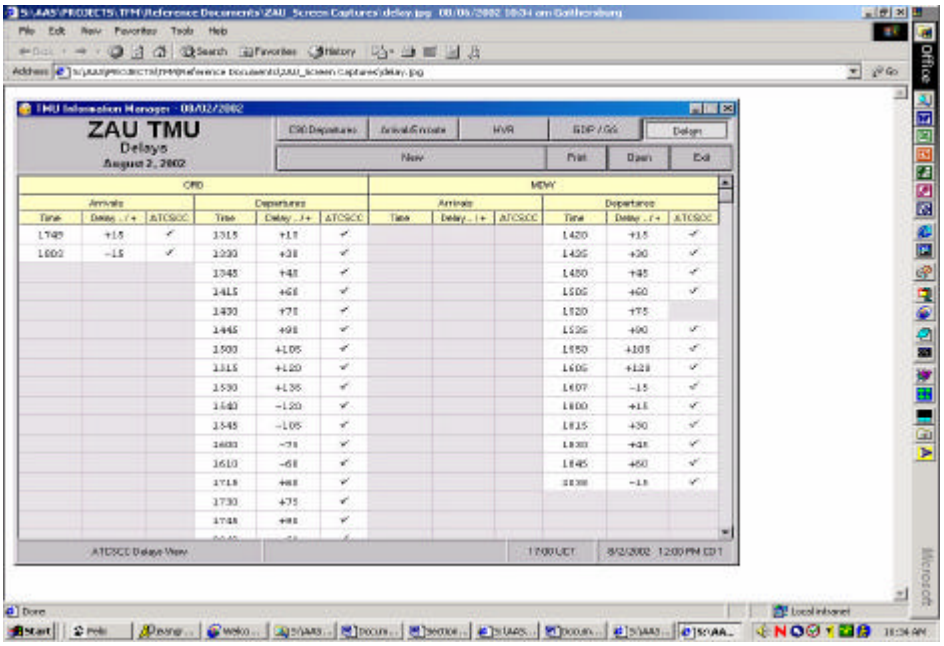


Exhibit 6-103. ZAU TMU Information Manager (4) Delays

6.3.15 ZAU TMU Log

The TMCs at ZAU use the TMU Log to record actions/activities taken at their positions. The information logged includes TMC on duty, configuration status, weather updates, and coordination activities. A Daily Record of Facility Operation report is generated from these TMC log entries

The information provided by this tool is all locally entered and captured as text in ACCESS database. This tool is used by all TM positions at ZAU.

Screen capture of the Daily Record of Facility Operation is provided in Exhibit 6-104. ZAU TMU Log.

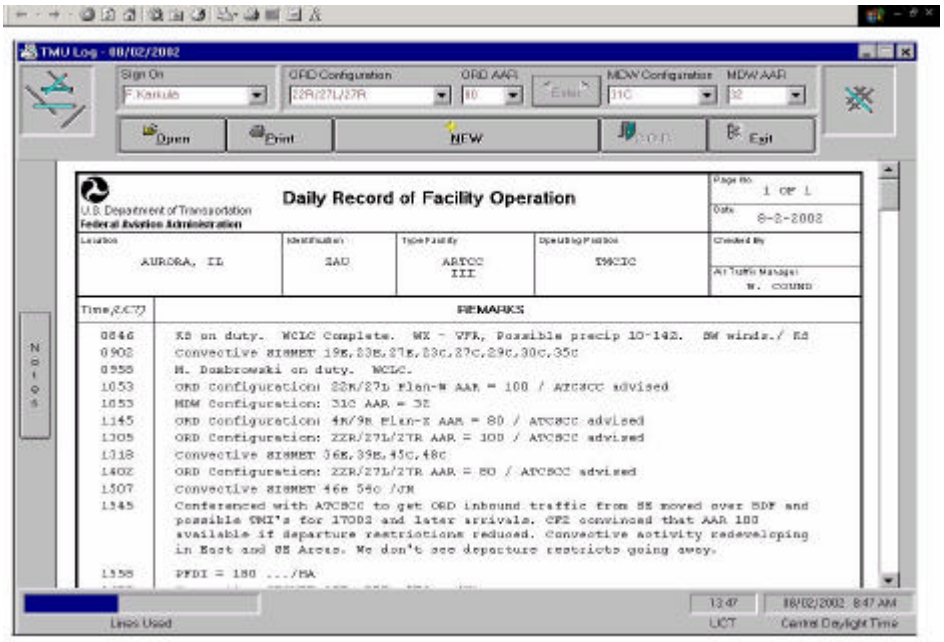


Exhibit 6-104. ZAU TMU Log

6.3.16 ZDC RT Find

The ZDC RT-FIND utility is a locally developed PC-based tool used by traffic managers at Washington Center. It allows traffic managers to quickly find local departure routes that link with SWAP routes. The routes maintained for the RT-FND utility augment the National Playbook routes by including a "transition" leg in front of the Playbook route. The transition leg is used to route flights from their standard route(s) to the Playbook routes. The RT-FND routes are locally maintained using manual editing. RT-FIND was described as being an addition to TMC Tools.

6.4 Other Tools

The following describes other FAA tools that have been developed not specifically for TFM but are being used at the TMUs.

6.4.1 ARTS Color Display (ACD)

The Automated Radar Terminal System (ARTS) Color Display (ACD) provides controllers at selected Terminal Radar Approach Control (TRACON) facilities with a stable, high-resolution color display and a graphical user interface for control functions. ACDs display radar targets for flights within and adjacent to the terminal area. Data blocks are optionally displayed for flights based on user-selected filters such as origin and destination. Overlays such as range rings and sector boundaries can be displayed.

The ACD supports all ARTS keyboard and trackball functions, enabling the ACD to directly replace the Full Digital ARTS Displays (FDAD) and Data Entry Display Subsystems (DEDS). The use of color on the ACD helps traffic managers differentiate between overlapping targets.

The ACDs use Sony Main Display Monitors (MDM) which are the same monitors used in the Standard Terminal Automation Replacement System (STARS) controller workstations and in the Display System Replacement (DSR) consoles.

ACDs are installed in the following TRACONs: New York, Reagan Washington National, Dallas/Fort Worth, Atlanta, Northern California, and Potomac Consolidated.

6.4.2 Corridor Integrated Weather System (CIWS)

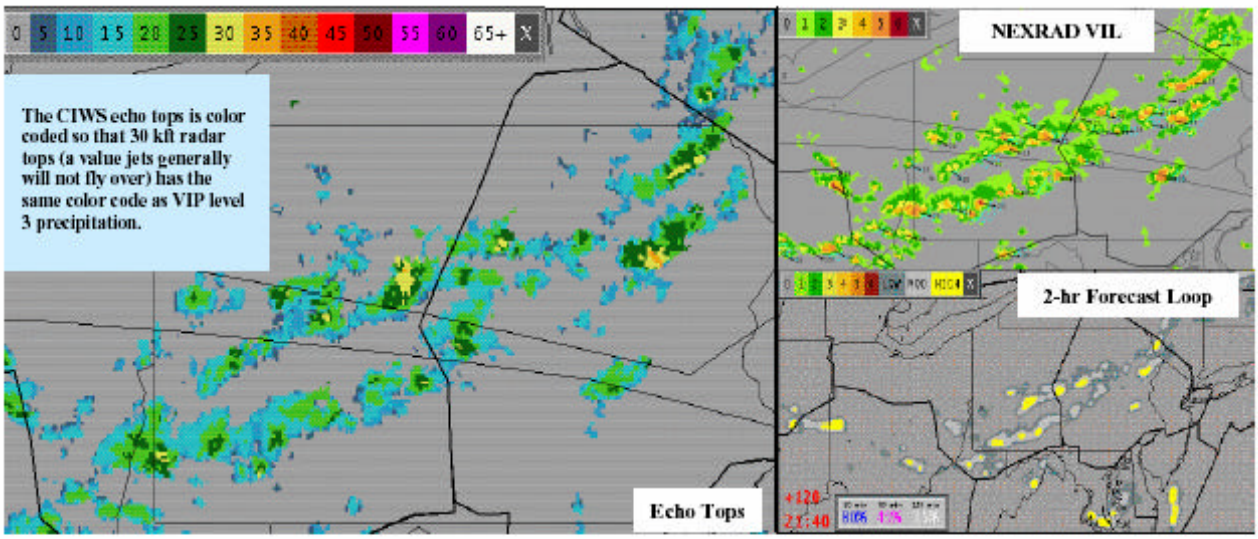
Corridor Integrated Weather System (CIWS) displays have been installed as a proof of concept product at ZOB, ZDC, ZAU, ZBW, ZNY, ZID, the ATCSCC and at N90, ORD, DTW, PIT, CLE and CVG. Airlines have access to CIWS via the Internet and CDMNet, as well as through dedicated displays.

CIWS was developed to provide enroute traffic flow managers with accurate, automated, and rapidly updated information regarding storm locations and echo tops to achieve more efficient tactical use of airspace, reduce controller workload and significantly reduce delay. CIWS provides enroute traffic flow managers with a 2-hour high resolution, animated growth and decay forecast of storms. CIWS products are intended to complement and supplement the CCFP.

Terminal and enroute weather sensors create the CIWS products. ASR-9 radars with their rapid update rate of 30 seconds are used to detect rapidly growing storm cells. NEXRAD provides 3-D storm information and information on boundary layer winds. Data from lightning sensors and GOES satellites is also integrated with the radar. TDWRs and ASR11 data can also be used to supplement or provide CIWS data input. Terminal Convective Weather Forecasts (TCWF) from 15 to 60 minutes have been adapted for use by CIWS as well. ITWS storm tracking and position extraction algorithms are used to provide CIWS precipitation and storm motion information. The Regional Convective Weather Forecast (RCWF) provides forecasts of prediction times from 15 to 120 minutes.

CIWS improvements (including its Enhanced Echo Tops product) allow specialists to find better paths through storms, reducing delay and maximizing airspace usage during bad weather. Pilots often fly over storms despite precipitation in the area, as long as they can fly over the tops, reducing the need to close airways during storms.

The CIWS tops algorithm uses a vertical interpolation technique employing data from two radar tilts to calculate tops. The tops prediction is based on a spatial resolution of 1 kilometer (versus the existing NEXRAD resolution of 4 kilometers). Echo top heights from each NEXRAD are mosaiced together to create a final picture with a spatial resolution of 2 kilometers.



CIWS display during the severe weather event of 24 August 2002. The RCWF provides CIWS 15-120 minute animated forecasts (lower right hand window). A key feature is the real time indication of forecast accuracy. The upper right window shows the NEXRAD VIL mosaic product. The echo tops product (left) shows that high level VIL returns are associated with relatively low echo tops. The CIWS echo tops information permitted many aircraft to safely fly over the storms in Pennsylvania, thus significantly reducing aviation delays.

Exhibit 6-105. CIWS NEXRAD and Echo Tops Display

6.4.3 Display System Replacement (DSR)

The Display System Replacement (DSR) receives track and other data from the FAA's Host computer and the Enhanced Direct Access Radar Channel (EDARC) and formats it for display to the controller, providing a highly reliable interface to the National Airspace System (NAS) for control of commercial, general aviation, and military aircraft in the United States.

Host computer data is provided over the primary network, and a commercial Ethernet network provides a backup channel for fail over and system maintenance. The backup network connects to the EDARC through a system interface unit and provides a completely independent path for sending track data to the sector console displays.

DSR is installed at all 20 ARTCCs, the FAA Technical Center in Atlantic City, New Jersey, and the FAA Academy in Oklahoma City, Oklahoma.

6.4.4 Dynamic Oceanic Tracking System (DOTS) Plus

DOTS Plus is an 'oceanic system' which provides three key air traffic management functions - Track Generation, Track Advisory, and Traffic Monitor Display. The combination of these capabilities ensures that traffic management is accomplished through the use of automated information gathering and distribution, route development, and gateway assignment.

DOTS Plus integrates all aspects of oceanic airspace management to provide decision support software tools for Traffic Management Coordinators (TMC) and Supervisory Air Traffic Control Specialists (SATCS).

DOTS is installed at the Oakland, New York and Anchorage Air Route Traffic Control Centers (ARTCCs), which control oceanic air traffic in international airspace. DOTS is also installed at the Air Traffic Control System Command Center (ATCSCC), which provides backup for Oakland oceanic responsibilities. At the Command Center, DOTS Plus will also be used for security (scanning the oceanic borders to provide advanced warning of unfriendly air traffic inbound to the NAS), and as a monitoring tool for demand estimation purposes.

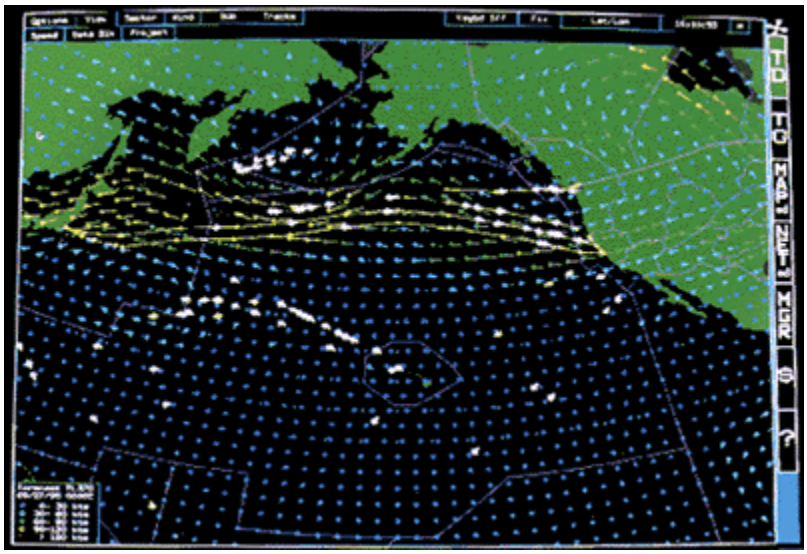


Exhibit 6-106. DOTS Plus display, showing oceanic tracks

The DOTS Plus system uses an open-system architecture, and implements improved network and track generation and track assignment. Communication is accomplished through the National Airspace Data Interchange Network (NADIN) Packet Switched Network (PSN). Note: At the current time, DOTS at the ATCSCC does not link directly to NADIN at the ATCSCC but goes first to ZTL and from there into NADIN.

DOTS Plus is designed to optimize fuel consumption and reduce controller workload. The use of a cost effective aviation upper winds forecast distribution capability contributes to the continuing emphasis on improving user opportunities for efficient use of oceanic airspace.

DOTS manages air traffic through the use of automated information gathering, and route development and analysis tools. DOTS uses workstation technology to generate flexible tracks, provide traffic advisories, and display aircraft positions using high resolution graphics to emphasize parameters affecting airspace management. Its goal is to provide oceanic traffic managers with the capability to improve fuel and time efficiencies in oceanic airspace.

DOTS computes and distributes oceanic tracks twice a day. When WARP/WINS data is integrated, these tracks will flex with changing wind patterns while reflecting separation standards. In addition, airspace availability advisories are provided to each aircraft, with consideration of current and projected traffic congestion and updated winds.

The Track Generation function uses forecast aviation weather, user operation, and site specific Air Traffic Control (ATC) flow requirements to compute a structured system of routes that allow the most efficient use of oceanic airspace. The resulting tracks take into consideration the varying separation requirements found in oceanic airspace. Traffic Management Unit specialists can also manually enter specialized traffic requirements into the track generation system.

The Traffic Display function accepts data from various aircraft flight data sources, as it monitors and projects aircraft progress entering and proceeding through oceanic airspace. The display of current and projected aircraft positions provides traffic management with the ability to plan the flow of oceanic traffic hours in advance. A key element is the validation and verification of aircraft position data. The system updates wind and temperature forecasts automatically by including current Pilot reports (PIREPS). These are then used in combination with flight plan data to project aircraft positions. All positions calculated from these data are compared with reported estimates to identify and automatically report differences.

DOTS facilitates the accommodation of user requests for time and fuel efficient routes. In order to provide users with the most efficient service, plans for traffic management must traverse the entire oceanic airspace. This requires close coordination with other ATC provider nations so that generated tracks and planned traffic are consistent with international requirements. The FAA has a Memoranda of Understanding (MOU) for cooperative testing of DOTS functions with several countries that also have responsibility for control of oceanic airspace.

DOTS in the Pacific demonstrated a potential fuel savings of five to seven percent. The implementation of DOTS included increased information regarding current and anticipated airspace availability, leading to greater flexibility in authorizing user-preferred routes. This provides savings in flight time as well as fuel costs.

Added functionality to provide capability to integrate near-real time weather information (from WARP/WINS) to the DOTS Plus database used to generate oceanic flex tracks is expected by the end of 2002.

6.4.5 Full Digital ARTS Display (FDAD)

The Full Digital ARTS Display (FDAD) provides TRACON controllers and traffic managers with monochrome displays of radar targets for flights within and adjacent to the terminal area. Data blocks are optionally displayed for flights based on user-selected filters such as origin and destination. Overlays such as range rings and sector boundaries can be displayed.

Some TRACONs have replaced the FDADs with ACDs (refer to Section 6.4.1, ACD).

6.4.6 Integrated Terminal Weather System (ITWS)

The ITWS (Integrated Terminal Weather System) provides terminal aviation system users with safety and planning products that characterize current terminal weather situations as well as forecast about 30 minutes into the future. This is achieved by integrating data products from various FAA and National Weather Service (NWS) sensors (e.g., Terminal Doppler Weather Radar (TDWR), Airport Surveillance Radar-9 (ASR), Next Generation Weather Radar (NEXRAD), Low-Level Wind shear Alert System (LLWAS), Automated Surface Observing System (ASOS), and other NWS systems. Products generated by ITWS include wind shear and microburst predictions, storm cell and lightning information, terminal area winds aloft, runway winds, and short-term ceiling and visibility predictions.

ITWS can differentiate between real weather radar returns from those caused by anomalous propagation. This system will be the primary tool used by Terminal air traffic management personnel to obtain, process and display current and predictive weather information.

6.4.7 Special Use Airspace Management System (SAMS)

Special Use Airspace Management System (SAMS) provides the means to track, coordinate, and report Special Use Airspace (SUA) and other related airspace. Special Use Airspace Management Program was a joint coordination effort between the FAA and Department of Defense (DOD) to develop procedures and establish automation requirements for increasing flexibility in the allocation and use of SUA by civil and military users. To comply with the legislative guidance, SAMS was developed on an open-system architecture and is capable of interfacing with other systems such as the Enhanced Traffic Management System (ETMS) to collect and disseminate data as required. The Military Airspace Management System (MAMS) is scheduled to be connected to SAMS in order to reduce the data entry workload at FAA facilities and to begin the development as a means to collect and analyze utilization data to promote the effective management of SUA.

SAMS will display and record SUA and other types of airspace area transactions tracked in the National Airspace System (NAS). Airspace transactions are normally considered to be when an action is taken on a segment/area scheduled, activated, paused, terminated, or nonuse of airspace for a specific use by a segment of the flying public. The transactions tracked are associated with:

- SUA
  - Restricted areas.
  - Prohibited areas.
  - Military operations areas.
  - Alert areas.
  - Warning areas.
- Other areas tracked.
  - Air Traffic Control assigned airspace (ATCAA).
  - Instrument flight rules military training routes.
  - Visual flight rules military training routes.
  - Refueling anchor.
  - Refueling track.
  - Other.

6.4.8 Surface Movement Advisor (SMA)

SMA provides aircraft arrival information, at 20-second intervals, to airline ramp personnel and towers. Its primary purpose is to increase awareness of traffic flow into the airport, giving ramp control operators precise touchdown times.

SMA information is used by airlines for better managing ground assets (gates, baggage operations, refueling, food service, etc.). Armed with information about the flight's position in the terminal airspace, gate and ramp operators and tower ground controllers using SMA also have an enhanced ability to reduce taxi delays, especially in inclement weather. For controllers and TMU specialists, the benefit is increased awareness of and confidence in the location/timing of arrivals to the airport.

The SMA list display provides the following basic information:

- Aircraft Identification
- Aircraft type
- Time
- Position of the aircraft relative to the arrival airport (lat/long, and distance in nautical miles)
- Estimated touchdown time
- Altitude
- Speed.

SMA was the first RTCA-recommended Free Flight program to be completed. SMA information became available at Philadelphia International and Detroit Metropolitan airports on December 18, 1998. In 1999, Chicago O'Hare, Dallas/Fort Worth, Newark and Teterboro airports all received SMA systems. Functions supported by the Free Flight SMA are not the same as those of the one-time prototype at Hartsfield Atlanta International Airport.

SMA information is routed through the Volpe Center to the FAA and the airlines (via the NASSI server).

Volpe Center's operations team now provides 24-hour, 7 day-a-week operational support for the SMA air traffic management information system.

SMA is a precursor to SMS (Surface Management System), which is expected to be developed as a part of the ongoing Free Flight program.

6.4.9 Traffic Management Advisor (TMA)

Traffic Management Advisor (TMA) is a strategic planning tool for en route controllers and traffic management specialists in the ARTCC, TRACON, and Tower. TMA affects traffic flow and planning of aircraft operating in en route airspace. It provides computer automation to enhance arrival sequence planning and the efficiency of air traffic operations in the extended terminal airspace surrounding major airports. Use of TMA neither decreases safety nor increases controller workload.

TMA enables en route controllers and traffic management specialists to develop complete arrival-scheduling plans ("meter lists") of properly separated aircraft. These plans then support early runway assignments that maximize the adapted airport's use of its available capacity. Significant fuel savings and reduced passenger delays result from efficiencies achieved through use of TMA.

TMA calculates arrival schedules in real time based on the following:

- Flight plan and track information received from NAS components, including ETMS, HCS, and Terminal Automation (ARTS, STARS, etc.)
- Information entered by traffic managers and controllers about airport configuration, required wake vortex separation and whether IFR or VFR rules apply to arrivals.

The TMA provides traffic managers with tools to coordinate the arrival traffic flow by graphically depicting the traffic demand and arrival schedules to the adapted airport(s). Graphic displays of arrival and delay information can be customized on an individual facility and user basis.

TMA PROCESSING DETAILS

The TMA uses a controller derived model of the TRACON runway eligibility rules in its scheduling, thus the schedules are closer to actual operations. Each Center/TRACON installation is adapted separately to support the particular facility where it is being used.

The tool uses an ASP flow rate algorithm to generate demand predictions based upon the filed speed and current ARTCC routing coupled to a very simple route from the ARTCC boundary to a common point within the TRACON representing all runways, known as a vertex. Aircraft are then scheduled to this vertex to meet an airport acceptance rate (AAR) without regard to separation requirements or standards at individual runways or adjacent dependent runways.

The TMA is a time-based strategic planning and control tool that consists of trajectory prediction, constraint-based runway scheduling, traffic flow visualization and controller arrival sequence, time and delay advisories. The TMA software components are hosted on a network of UNIX workstations. A simple hardware/software diagram is shown in Exhibit 6-107. TMA Simplified Hardware/Software Diagram. On the left side is the operational air traffic control system from which the TMA receives aircraft track data, flight plans and various controller entries. These data are passed to the communications manager (CM) for distribution to the

prediction, scheduling and visualization processes. The CM also transfers the atmospheric data to the prediction and visualization algorithms. The time prediction process generates estimated times of arrival (ETA) for all aircraft to the meter fixes and all eligible runways. This is the most computationally intensive process and is a function of the number of aircraft in the system. It was thus designed to be scaleable with more computers. The figure shows four processors allocated for this purpose. The ETA data are used with ATC constraints to generate scheduled time of arrivals (STA). The ETA, STA and other information of interest are displayed in various graphic formats on the TMA displays. The CM also transmits STA and ETA information back to the operational ATC HOST computer in the form of aircraft sequence, scheduled meter fix and outer metering arc crossing times and delay advisories to be presented on the controllers' Plan View Displays (PVD).

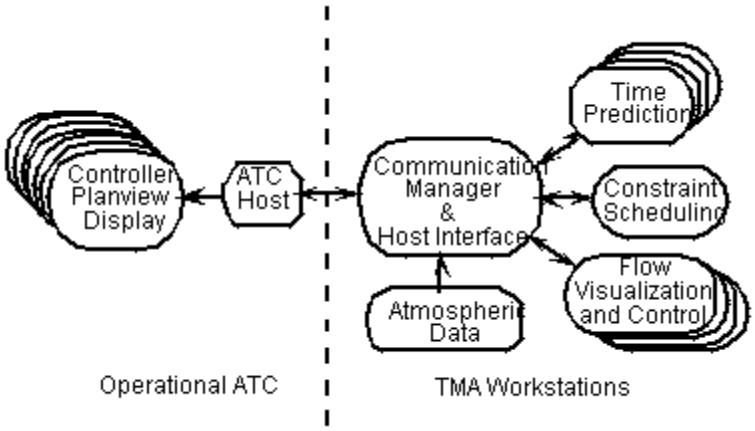


Exhibit 6-107. TMA Simplified Hardware/Software Diagram

Time Prediction

The time prediction algorithms are the foundation of TMA. The time prediction is separated into two modules: the route analyzer (RA) and trajectory synthesis (TS). The RA generates, based upon user generated site-specific adaptation logic and heuristics, a two-dimensional path from the aircraft's current position to its final destination. The complexity of this path is determined via the necessary adaptation. This two-dimensional path is coupled by the TS with the aircraft's current energy state and atmospheric data to calculate a fuel optimal four-dimensional trajectory using aircraft specific mathematical performance models. ETAs are extracted from this trajectory for specific points of interest. The TS trajectories include all modes of flight including ascent, cruise and decent.

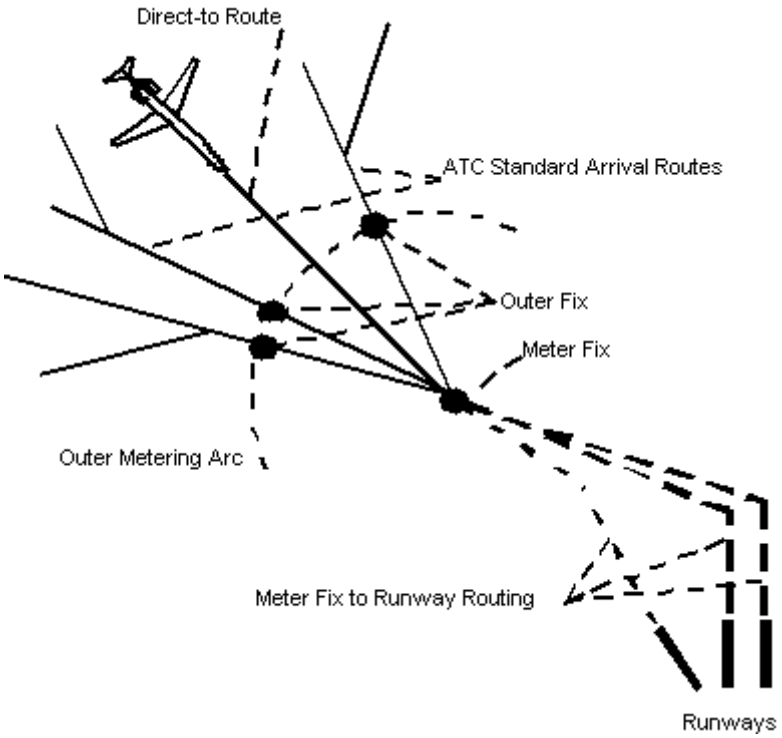


Exhibit 6-108. Typical TMA Routing

The typical routing used by the TMA for ETA determination is the one which will generate the earliest time of arrival for a particular aircraft. This routing is referred to as the "direct-to" route. The direct to route extends from the aircraft's current location to the transition fix between the ARTCC and TRACON (meter fix) as shown in Exhibit 6-108. Typical TMA Routing above. At the meter fix transitional routes are generated to all eligible runways based upon current airport landing configuration. The figure shows the example of possible TRACON routings for an aircraft landing in a South flow airport configuration from a Northwest meter fix. These transitional routes are also based upon the shortest possible path from the meter fix to the runway. The RA determines these potential routings based upon the adapted airport configuration information. The route information is used in the TS to determine the earliest ETA's to the meter fix, an outer metering arc, shown in figure, and all eligible runways. The ETA's for each aircraft are updated with each track or flight plan update. The grouping of the ETA's represents the arrival "demand" on the runways, airport and meter fixes. This demand information is the input required for the constraint based scheduling.

Constraint Scheduling

The constraint scheduling logic and algorithms necessary for the diverse operational requirements of ATC is beyond the scope of this paper and will only be covered briefly. The functional logic for the scheduling algorithm is a modified first-come-first-serve (FCFS) algorithm. The scheduling constraints used to modify the FCFS schedule are the factors associated with the separation safety requirements specified by FAA regulations. The FCFS algorithm is coupled with delay reduction runway allocation logic and a Center/TRACON

delay distribution function (DDF). The scheduling algorithms ensure conflict-free schedules simultaneously at both the meter fix and runway threshold or the final approach fix (FAF) during visual meteorological conditions.

Meter Fix Constraints

Scheduling is accomplished in a multi-step process. First is the generation of an initial schedule to each of the meter fixes. The sequence is determined based upon the earliest ETA to the meter fix. The first aircraft in the sequence is scheduled at its earliest ETA. The next aircraft in sequence is then scheduled to its earliest ETA or the time necessary to ensure in-trail separation constraints are met. The in-trail separation constraints can be specified as any value greater than or equal to the minimum separation standards of 5 miles for similar aircraft types crossing the same meter fix to the same airport destination. Thus an initial meter fix separation based schedule is established for all fixes.

Runway Constraints

Scheduling to ensure required threshold or FAF separation is met is the next major step. The threshold separation requirements are the minimum of the FAA wake vortex standards based on aircraft weight class. The TMC may increase these values due to weather or other significant events. The scheduling algorithm selects the first aircraft from each of the initial meter fix schedules. From this group of aircrafts, an "order of consideration" (OOC) is generated by using the ETA to the runway threshold. The aircraft with the earliest runway is selected as the first aircraft of the OOC. Then, using the meter fix scheduled time of arrival (STA) and the meter fix to runway transition time, the first aircraft in the OOC is scheduled to the threshold. The next aircraft from that meter fix is added to the order of consideration for possible selection. The next aircraft is scheduled using its meter fix STA, transition time and the specified threshold separation requirements. Once the second and subsequent aircraft are scheduled, threshold separation delay is known. If this delay is greater than the Center/TRACON DDF then the amount greater than the DDF is fed back to the meter fix STA. The modified meter fix STA causes modification to the aircraft's in-trail separation based meter fix schedule. The process is repeated until all aircraft are scheduled.

Flow Rate Constraints

Once these separation-based constraints are considered the flow rate constraints are evaluated. The primary flow rate consideration is the Airport Acceptance Rate (AAR). Flow rates can also be placed on a particular runway, meter fix or even the TRACON as a whole. The AAR is normally defined as the rate of aircraft permitted to land at the airport over a specified time period. This flow rate constraint is added because controllers cannot land aircraft at minimum separation for an extended period of time, due to workload and other considerations. Among these considerations that affect the selection of an AAR by a TMC are: airport ground movement or congestion, departure demand, airspace complexity as well as the basic capacity factors discussed earlier. The current scheduled flow rate is computed by a simple algorithm that counts the number of aircraft scheduled to land over an adaptable time interval. This scheduled flow rate is compared with the specified flow rate constraint. If the scheduled flow rate during the specified time interval exceeded the specified rate, the excess aircraft are pushed back into the next time interval.

Runway Allocation

The runway allocation algorithm within the scheduling process is event driven. The events are:

- Initial aircraft knowledge as determined by TMA receipt of an estimated or departed flight plan from the ATC computer
- A stable track-based ETA is determined
- Freezing of the schedule prior to transmission to the ATC Host computer for display on the controllers' PVDs.

At each of these events the total system delay associated with the particular aircraft scheduled to its current runway is compared with the total system delay if the aircraft was allocated to an alternate runway. The comparison includes any delay incurred in the TRACON due to a longer meter fix to runway routing. The runway allocation algorithms are controlled by TMC heuristics. These heuristics are captured in adaptation parameters that are a function of airport configuration and aircraft type. The parameters are eligible runways, primary, secondary, and in some cases tertiary along with the amount of system delay savings necessary to allocate to an alternate runway. The adaptation can also be used to favor longer TRACON routes if it is beneficial for controller workload due to airspace complexity issues.

Center/TRACON Delay Distribution

The basic premise for the allocation of economically efficient delay between the Center and TRACON for commercial jet transports is that the delay distribution is a function of the uncertainty of the actual meter fix delivery time and fuel burn as a function of altitude. Another key consideration is efficient workload distribution between the Center and TRACON airspace. Delay is directly related to controller workload and the scheduler has a parameter that allows the delay distribution to be set between the Center and TRACON. The effect of the delay distribution is to place enough pressure on the TRACON to maintain a fully utilized final approach course throughout a rush. Typically the TMA DDF is set to maintain a 3 to 4 aircraft

final with the TRACON controllers using heading and speed control. The effect of the delay distribution in the Center is to postpone the onset of holding thereby reducing the overall amount of time that holding is required.

Flow Visualization

The TMC interface consists of: timelines, load graphs, a plan view display, and a linear list. Each of the displays presents different views of the flow of air traffic in the arrival airspace. The timelines display the predicted arrival demand, schedule, and delay for each aircraft in an analog format. The format is a series of vertical lines with time reference to the meter fixes and runway threshold. The individual aircraft identification size and track status are displayed juxtaposed to the time-to-go reference. The bottom of the timeline is current time. The load graphs display a running average of the aircraft demand, schedule and delay. The load graphs provide flow information that allows demand size and duration to be determined. The Plan View display provides a spatial display of individual aircraft track information. The information is presented over scaleable chart overlays of the Center and TRACON airspace. The final format is a list or tabular presentation of demand, schedule and delay. This format is similar to the existing ASP TMC display with color coding enhancements.

Controller Advisories

TMA generates controller advisories which are transmitted to the operational ATC Host computer. The advisories are displayed superimposed on the sector controller display as a list of aircraft designators in a time ordered sequence. The aircraft identifier is displayed adjacent to the scheduled crossing time and delay to be absorbed. These advisories are referenced to both the meter fix and outer metering arc for jet aircraft and only the meter fix for low altitude turbo prop and prop aircraft. Only the advisories relevant to a specific sector are displayed on that controller's PVD. The delays are distributed between the sector controllers working the jet traffic in both high (above 24,000 ft.) and low altitude. The high altitude controller absorbs all but an adapted minimum amount of the center required delay where jet aircraft are most fuel efficient. The delay distributed to low altitude controllers is for both workload distribution and to maintain pressure on the TRACON meter fixes to ensure a volume of aircraft are available in the event that the TRACON determines that capacity can be increased. The low altitude controllers are also required to absorb delays associated with all other traffic.

The advisories are similar to those used currently by ASP with the following exceptions:

- The advisories are presented to the high altitude controllers in a single time ordered list referenced to the outer metering arc.
- The outer metering arc is at an adaptable fixed radial distance from the meter fix.
- The outer metering arc is usually 50 to 60 n.mi from the meter fix.

This presentation is different from Host ASP advisories which are referenced to outer fixes and presented in multiple lists per arrival sector. Another TMA function allows the controller to swap or change sequence of the aircraft within the list for sector tactical considerations.

6.4.10 User Request Evaluation Tool (URET)

The URET strategic conflict probe, notification, trial planning, display, and auto-coordination functions are designed to support controllers and specialists in monitoring sector flows, and aid in detecting individual conflicts and flow problems earlier than has been possible in the past.

URET is primarily an enroute tool, however, given the long transitions for arrivals necessitated by structured routings, its use affects arrival and departure efficiencies as well. Traffic is generally routed along structured ATC preferred and non-preferred routings to increase the predictability and reduce controller/specialist coordination requirements. However, there are flow consequences to the use of structured routings. Impacts are evident at both departure and arrival points, as well as enroute. In order to control enroute flows, departures are often delayed to stagger entry into the limited number of routes. Enroute spacing becomes more of a problem, requiring controllers and specialists to use altitude and speed separation tactics, MIT restrictions, even enroute airborne holding to maintain the flow and utilize the airway efficiently. Airspace is crowded along route corridors and flights are not always assigned desired altitudes (which can reduce operational efficiency and / or passenger discomfort if there is turbulence at some altitudes). Arrivals must be sequenced many hundreds of miles from destination. SIDs, STARs, one-way routes, arrival and departure restrictions are used to segregate major flows of traffic. They utilize floors, ceilings, arrival and departure corridors to thread flows coming from different quadrants to various runway ends. Although these restrictions are created to organize flows to and from specific airports, their effect can extend a considerable distance from the airport, some as far out from destination as 250 nm.

In the TMU, URET may be used to monitor these flows, and to suggest more efficient (optimum wind routes) alternative routings in order to increase or better utilize enroute airspace, particularly during bad weather.

In addition, URET provides a mechanism for more effectively and safely merging / sequencing traffic into departure and arrival streams earlier than is possible without the use of this tool.

URET can be used to provide information in support of traffic management activities in the following ways:

- Trial Planning allows controllers/specialists to test merge points and fit in more flights into a given route earlier, reducing the need for/frequency of delays in call for release authorization, resulting in better route utilization. The advisory software can predict an aircraft-to-aircraft conflict 20 minutes ahead in time. Red intersecting lines of two airplane flight paths appear on the monitor if a requested change is a conflict. URET also probes to see if a change will cause an airspace conflict with restricted airspace.
- The 20-minute look-ahead and automatic coordination features reduce verbal coordination requirements, and may allow the number of altitude restrictions required at sector boundaries to be reduced (where there are adjacent URET sectors). By reducing the need for coordination, or by making it easier to coordinate, URET can help eliminate some restrictions, and confine the extent of others to areas closer to airports. Auto-coordination is silent, non-interfering, and asynchronous, in

contrast to voice coordination, which requires both the initiator and the receiver to be on the interphone at the same time.

- Conflict detection algorithms give controllers and specialists early forewarning of isolated conflicts or more general flow management issues.
- In URET environments, TM specialists are better able to manage anticipated peaks (daily peaking patterns). Standard techniques for controlling departure times are often required during peak times, when a significant amount of the departing traffic is flight planned to enter the same route to the same (already crowded) destination airspace. URET capabilities support merging of traffic more efficiently into routes so releases can be approved more often and with greater confidence. Using URET, specialists can find the holes needed more quickly and often fewer control actions are required to maneuver flights into the stream.
- URET allows for reduced vulnerability to unanticipated peaks. Requiring aircraft to fly ATC Preferred or other structured routes in order to preserve the current degree of predictability is not as necessary when URET is installed since specialists can monitor sector URET displays and get an instant indication of the number of strategic conflicts for which that sector is responsible. Because these conflicts are notified with alert times substantially longer than are required to resolve conflicts tactically, specialists have an opportunity to recognize a developing peak situation with time to take some remedial action.

URET processes real-time flight plan and track data from the ARTCC Host computer through a one-way interface. These data are combined with site adaptation, aircraft performance characteristics, and winds and temperatures from the National Weather Service in order to build four-dimensional flight profiles, or trajectories, for all flights within or inbound to the facility. URET also provides a reconformance function that adapts each trajectory to the observed speed, climb rate, and descent rate of the modeled flight. For each flight, incoming track data are continually monitored and compared to the trajectory in order to keep it within acceptable tolerances.

URET maintains current plan trajectories, i.e., those that represent the current set of flight plans in the system, and uses them to continuously check for conflicts. When a conflict is detected, URET determines which sector to notify and displays an alert to that sector up to 20 minutes prior to the start of that conflict. URET also provides a trial plan function. Trial planning allows specialists to check a desired flight plan amendment for potential conflicts before a clearance is issued.

The URET Computer Human Interface (CHI) provides both text and graphic information. At the TMU, usually the only URET interface is the textual flight display at present. The text-based Aircraft List and Plans Display manage the presentation of current plans, trial plans, and conflict probe results for each sector. The Graphic Plan Display provides a graphical capability to view aircraft routes and altitudes, predicted conflicts, and trial plan results. In addition, the point-and-click interface enables quick entry and evaluation of trial plan route, altitude, or speed changes. Finally, the Wind Grid display provides a visual representation of forecast winds and temperatures at selected altitudes.

6.4.11 Weather And Radar Processor (WARP)

The Weather and Radar Processor (WARP) is the primary tool used by en route air traffic management personnel to obtain, process and display weather information. WARP supports the FAA's mission of ensuring a safe and efficient National Airspace System.

WARP provides enhanced weather information to air traffic controllers, traffic management specialists, area supervisors, and the Center Weather Service Unit (CWSU) meteorologists. WARP receives and consolidates weather data from multiple sources into a single database, and analyzes, generates and displays specialized value-added aviation weather products to support en route air traffic control operation.

WARP is the primary tool used by the meteorologists located at the air route traffic control centers (ARTCCs) and the air traffic system control center (ATCSCC) to receive, process and display weather information. The CWSU meteorologists are provided with processing tools that integrate information that formerly resided on four different systems into a single workstation. The WARP weather briefing terminals are located at the traffic management unit (TMU) and area supervisor's stations. WARP provides TMU personnel with current and long-range forecast weather conditions for strategic planning, and air traffic control supervisors with advance notice of approaching / developing hazardous weather conditions for tactical-decision assistance.

6.4.12 Enroute Information Display System (ERIDS)

ERIDS is an open architecture, completely COTS system with a browser interface and an Oracle database. It is installed for operational beta use at three ARTCCs (ZJX, ZLC, ZBW), at control sectors and in the TMU at each of these facilities.

ERIDS is installed at sector positions with touch screen interfaces. Supervisor positions are equipped with a flat screen monitor and a mouse. ERIDS allows controllers and specialists to select, view, and search a large number of local and national ATC documents and plates quickly, send messages within the facility (to be expanded for messaging between facilities in future), as well as request and receive near real-time NOTAMs, weather and TM messages at an ERIDS position.

TMU specialists use ERIDS to:

a) Communicate TM decisions to sector controllers and within the TMU
b) Pull up charts / approach plates / airport information before deciding on an initiative, or to provide routing information (particularly for airports where ATC operations are limited, or destinations out their airspace
c) View NOTAMs applicable to their particular sector or specialty.

ERIDS data is derived from:

- ATPUBS for ATC documents
- NFDC and AVN for official releases of NFDC (national adaptation data) and AVN data (approach plates, charts, maps, etc.) installed during the regular 56-day cycle.
- USNS for live feed of NOTAMs.
- Sites for site-specific materials such as LOAs, SOPs, etc.
- Sector positions and TMU for real time messages.

The following are some displays from ERIDS.

Exhibit 6-109. ERIDS Main Page Display (set up for TMU)

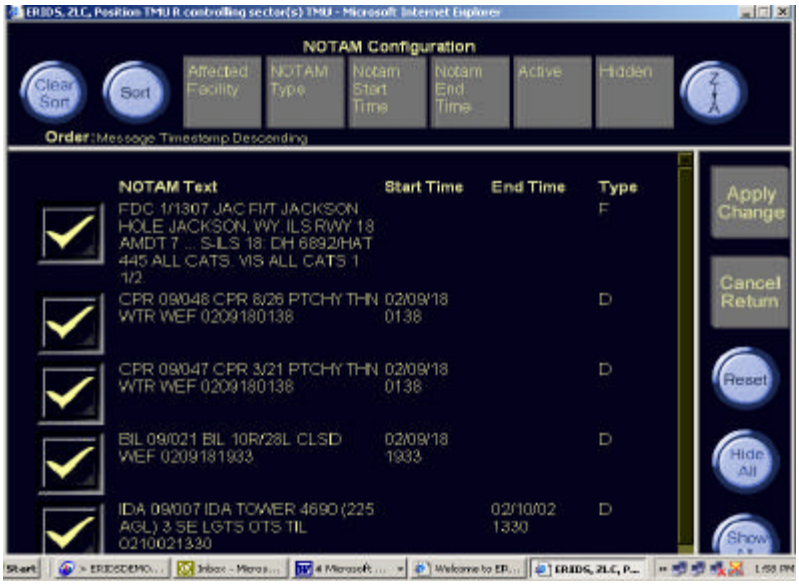


Exhibit 6-110. ERIDS NOTAM Configuration Page

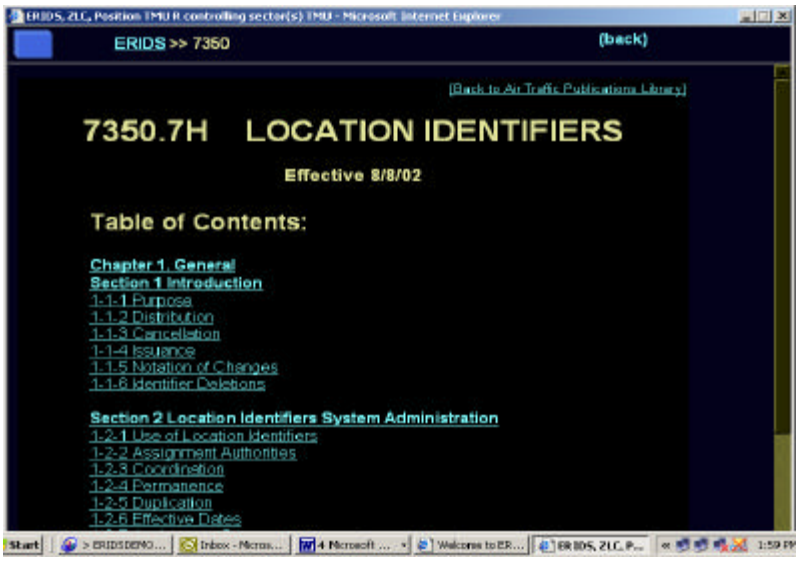


Exhibit 6-111. ERIDS Location Identifier Document Display

Exhibit 6-112. ERIDS Approaches Selection Page

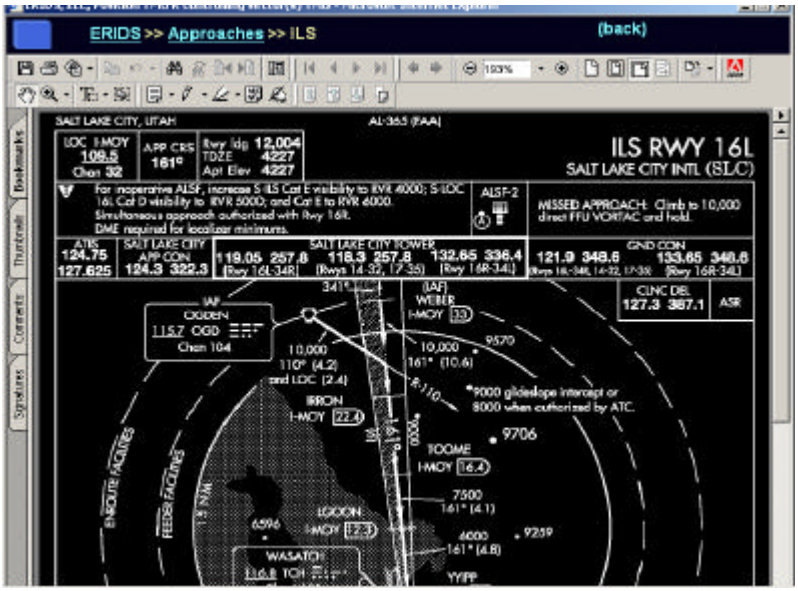
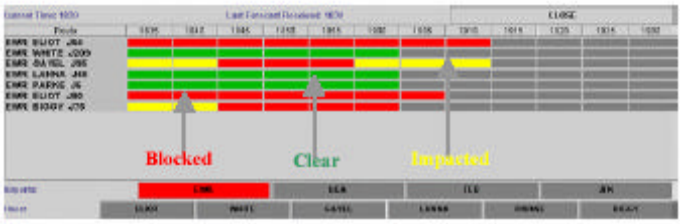


Exhibit 6-113. ERIDS Approach Plate Display

6.4.13 Route Availability Planning Tool (RAPT)

The purpose of the Route Availability Planning Tool (RAPT) is to provide traffic managers with a tool to help reduce departure delays during poor weather. RAPT is installed in ZDC, ZNY, N90 and NY area towers as a proof of concept tool.

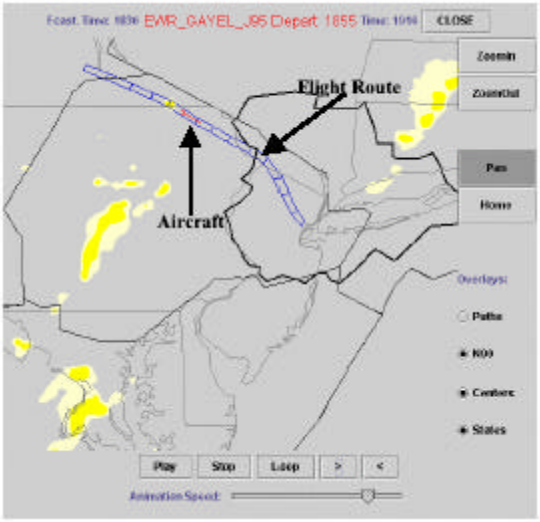
RAPT uses ITWS 1-hour forecasts and a site-specific departure route database to make accurate departure impact predictions available to traffic managers for all the important routes in the airspace. RAPT produces timelines for various departure routes from each runway at an airport. Each timeline gives the status (Clear, Impacted, or Blocked) of future departures along a particular route.



Using the 1-hour ITWS hazardous weather forecast, RAPT predicts which future departures will be BLOCKED (red time blocks), IMPACTED (yellow) and CLEAR (green). Clicking on a block brings up a movie loop of the forecast and the selected departure.

Exhibit 6-114. RAPT Timeline Display

Clicking on a departure brings up a movie loop of the weather forecast and the aircraft location for the scheduled departure time, providing critical information about the feasibility of the departure at its scheduled time.



This RAPT forecast movie loop display shows hazardous weather (dark yellow), departure path and flight animation (red X) for a BLOCKED departure.

Exhibit 6-115. RAPT Forecast Movie Loop Display

Future development plans include connecting RAPT to the CIWS 2-hour forecast, making RAPT web-based for airline use, displaying projected arrival aircraft location on the forecast movie

loop, and incorporating estimates of forecast reliability into the departure predictions. The following diagram also indicates that eventually ETMS arrival data and DSP departure data may also be fed into RAPT. Shaded areas on the diagram indicate components yet to be developed.

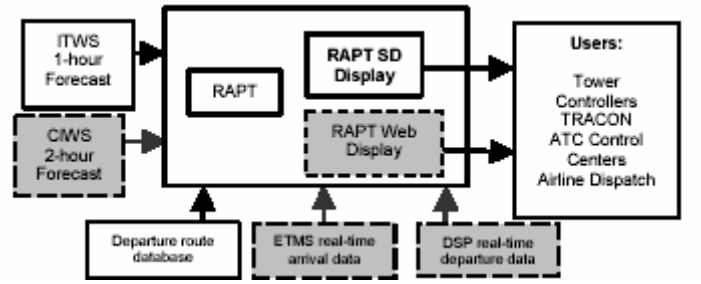


Exhibit 6-116. RAPT Functional Diagram